

THE ROYAL
NATURAL HISTORY

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THE EUROPEAN BISON.

THE ROYAL NATURAL HISTORY

EDITED BY

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ILLUSTRATED WITH

Seventy-two Coloured Plates and Sixteen Hundred Engravings

W. KUHNERT, F. SPECHT, P. J. SMIT, G. MÜTZEL, A. T. ELWES, J. WOLF,
GAMBIER BOLTON, F.Z.S.; AND MANY OTHERS

VOL. II.

SECTION III.

LONDON
FREDERICK WARNE & CO.
AND NEW YORK

1894

25

MORRISON AND GIBB, PRINTERS, EDINBURGH.



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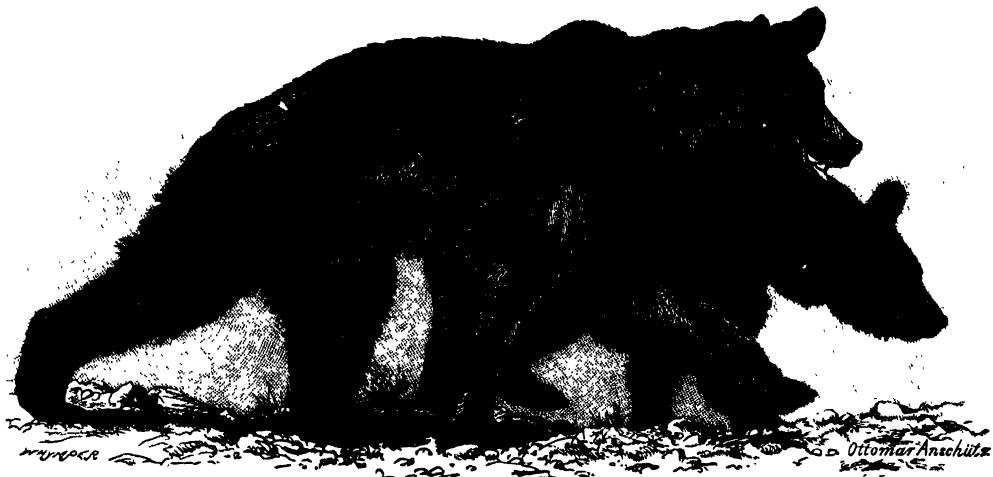
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THE ROYAL NATURAL HISTORY.



MAMMALS.

CHAPTER XVI.

CARNIVORES,—*continued.*

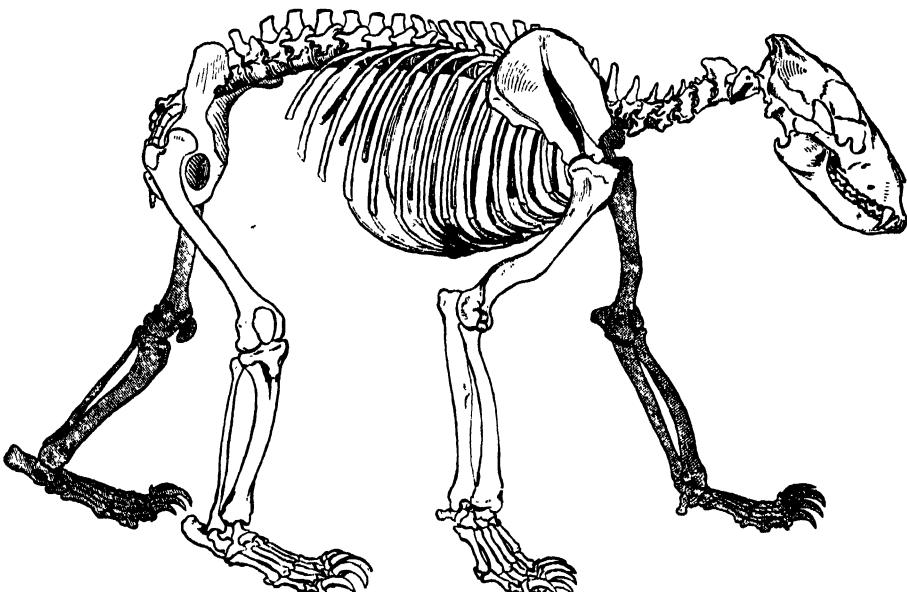
BEARS.

Family *URSIDÆ*.

THE bears are so different in appearance from the other Carnivores that no one could fail to recognise their representatives at a glance, or would hesitate to admit that, so far at least as living forms are concerned, they are entitled to constitute a group by themselves. The number of species included in the family is comparatively small; and the whole of them are arranged under three genera, two of which are represented by but a single species each.

Bears differ from the Carnivores hitherto noticed in an important feature connected with the hinder-part of the under-surface of the skull. Thus, whereas in all the preceding families the so-called tympanic bulla at the base of the internal portion of the ear forms an inflated bladder-like capsule, which is

generally divided internally by a larger or smaller bony partition, in the bears (as well as in the following families of the raccoons and weasels), this bulla is depressed and flattened, and has no trace of an internal partition; and its mouth, leading to the external ear, is produced much further outwards. There are also other characters connected with the skull which help to distinguish the bears and the members of the next two families from the Carnivores hitherto described, but the bulla alone is sufficient to determine at a glance to which of the two groups any given skull may belong, and the reader will accordingly perceive how important is this apparently insignificant feature. The degree of inflation of the bulla of the skull is doubtless associated with the acuteness of hearing; the Carnivores with the longest ears, like the African fennec, having larger bullæ than their nearest



SKELETON OF BEAR.

relatives. Bears are notoriously deficient in the sense of hearing; and it is probable that raccoons and weasels are also less acute in this respect than cats, civets, and dogs. Although many of the Carnivores with inflated bullæ have, like the cats, comparatively small ears, it is noteworthy that no bear, raccoon, or weasel has these organs of very large dimensions, while in some instances they are almost absent.

The members of the bear family are characterised by their heavy and massive build, their thick limbs, extremely short tails, and the presence of five toes, armed with powerful claws, on both the fore and hind-feet. Moreover, when walking, the whole sole of the foot is applied to the ground, in the old-fashioned plantigrade manner, so that the impression of a bear's foot presents a considerable superficial resemblance to that of a man. The claws of the feet are incapable of being retracted, and are well adapted for digging, although no members of the family are in the habit of constructing burrows for themselves after the manner of foxes. In most bears the under surface of the sole of the foot is

completely devoid of hair; and the ordinary gait is peculiarly slow and measured. All the bears are of considerable bodily size, while some of them are among the largest of the Carnivores.

The living species of bears, with which alone we are at present dealing, are likewise readily distinguished from other Carnivores by the characters of their teeth. They agree with the true dogs in having two pairs of molars in the upper jaw, and three pairs in the lower jaw, but the shape of these teeth is different; the crowns being nearly flat, very broad, and mainly adapted for grinding, while those of the upper jaw are either oblong or square, and, therefore, quite unlike the triangular upper molars of the dogs. Then, again, the flesh-tooth in both jaws is very unlike that of ordinary Carnivores; the upper one being small, and having no inner root, and its crown looking much like that of a molar. Similarly, the lower flesh-tooth (which we may once more remind our readers is the first of the molar series, while the upper one is a premolar) is very like the two molars by which it is followed. A third distinctive feature is that the first three premolar teeth in both jaws are exceedingly minute, and are very generally shed when their owner attains maturity.

The peculiar characteristics of the cheek-teeth clearly indicate that the food of the bears is very different from that of other Carnivores; and, as a matter of fact, the majority of these animals subsist on a vegetable diet, or on insects, to a much greater extent than on flesh. From their evident descent (as we shall fully indicate later on) from dog-like animals, it is clear that the peculiar features of the dentition of the bears have been acquired; and we may hence regard these animals, so far as their teeth are concerned, as highly specialised. The loss of the tail is likewise a specialised feature. On the other hand, in their retention of the old-fashioned plantigrade mode of walking, bears are much more generalised animals than dogs, and in this respect retain a feature which was present in the ancestral types from which the two groups have sprung.

The whole of the members of the family have a marked resemblance to one another, so that the characters by which the different species are distinguished are apparently somewhat trivial. Their fur is coarse, and generally long, thick, and shaggy, although it may be short and thinner in some of the tropical species. Except for the not unfrequent presence of a white collar round the throat, the fur is nearly always of one colour, and generally some shade of either brown or black. It is true, indeed, that the Polar bear is a marked exception to this rule, but in this case the colour of the fur has evidently been specially modified to suit the natural surroundings. The great prevalence of black among the bears is a feature unknown in any other group of Carnivores, and is, indeed, rare among Mammals in general.

Bears have a wide geographical distribution, occurring throughout Europe, Asia, and North America, while one species inhabits the South American Andes, and another the African Atlas. South, however, of the Atlas not a single member of the family is to be found throughout the length and breadth of Africa. Geologically speaking, true bears, that is to say those which can be referred to the genera now living, are of comparatively recent origin, none being yet known before the Pliocene, while it is not till the succeeding period that they became abundant. This late appearance of the bears is in harmony with what we have already stated as to their specialisation.

THE TYPICAL BEARS.

Genus *Ursus*.

With the exception of the Indian sloth-bear and a peculiar species from Tibet, all the bears are now generally included in the genus *Ursus*. This genus is characterised by having a total of 42 teeth (when all the small premolars are present), of which $\frac{3}{4}$ are incisors, $\frac{1}{4}$ canines, $\frac{4}{4}$ premolars, and $\frac{3}{4}$ molars on each side. In the adults, as already mentioned, several or all of the three anterior premolars may disappear from both jaws, although the one immediately behind the tusk may remain longer than the others. The molar teeth are characterised by their crowns being longer than they are broad; the last upper molar being a much elongated tooth, while in the lower jaw the last molar is shorter than the tooth which precedes it. As a rule, the soles of the feet are naked; and the claws are of moderate length and curvature. As in the other genera of the family, the ears are small, erect, and thickly haired; and the pupil of the eye is round. The geographical distribution of the genus is coextensive with that of the family.

THE POLAR BEAR (*Ursus maritimus*).

Not only does the Polar bear differ from all other bears by its pure white coat, but it is also distinguished from the greater number of white Mammals in that this colour is retained at all seasons of the year, instead of being exchanged in summer for a darker tint. In addition to this distinctive white coloration, the Polar bear is further characterised by the relatively small size and extremely elongated form of its head, as well as by the molar teeth being relatively smaller and narrower than in the other members of the genus. Moreover, the soles of the feet have a certain amount of hair growing upon them, doubtless for the purpose of enabling the animal to have a better hold upon the ice. The neck is also longer than in other bears, while the ears are unusually small. It is one of the largest members of the group, not unfrequently attaining a length of close upon 9 feet, although exact measurements from recently killed wild examples are but few.

The Polar bear is found throughout the Arctic regions of both hemispheres. It is now rare on the south-western coasts of Spitzbergen and Novaia Zemlia, where the ice almost completely disappears in summer. According to Baron Nordenskiöld, it is more common on the northern parts of those islands, where there is perpetual ice. On the north coasts of America and Asia it is found everywhere, and becomes more and more numerous as we travel northwards. In Labrador, where it is now very rare, there is evidence that it was once comparatively common, and Dr. A. S. Packard is of opinion that its range originally extended even down into the State of Maine. The white bears seen by John Cabot in the year 1497 are believed by Dr. Packard to have been observed in Newfoundland; while further evidence of their former existence is afforded by the observations of Corte Real in 1500 and Cartier in 1534. The bones found in the shell-mounds of Goose Island, Casco Bay, Maine, are considered to belong to the present species, and thereby indicate the probability of its range having extended thus far south.

In Southern Labrador the Polar bear seems to be totally extinct, the last specimen that was seen on the shores of the Strait of Belle Isle (dividing Labrador from Newfoundland) having been killed in the year 1849. In Labrador the range of the white bear overlaps that of the American black bear.

Habits. Baron Nordenskiöld states that the Polar bear generally lives on such coasts and islands as are surrounded by ice, while it is often found on the ice-fields far out at sea, which form its best hunting-grounds. In regard to the numbers of these animals, he states that the Norwegian "vessels from Tromsöe brought home in 1868 twenty, in 1869 fifty-three, in 1870 ninety-eight, in 1871 seventy-four, and in 1873 thirty-three bears. It may be inferred from this that the Norwegian walrus-hunters kill yearly on an average at least a



POLAR BEAR CLIMBING A FLOE.

hundred bears. It is remarkable that in this large number a pregnant female or one with newly-born young is never found. The female bear appears to keep herself well concealed during the time she is pregnant,—perhaps in some ice-hole in the interior of the country."

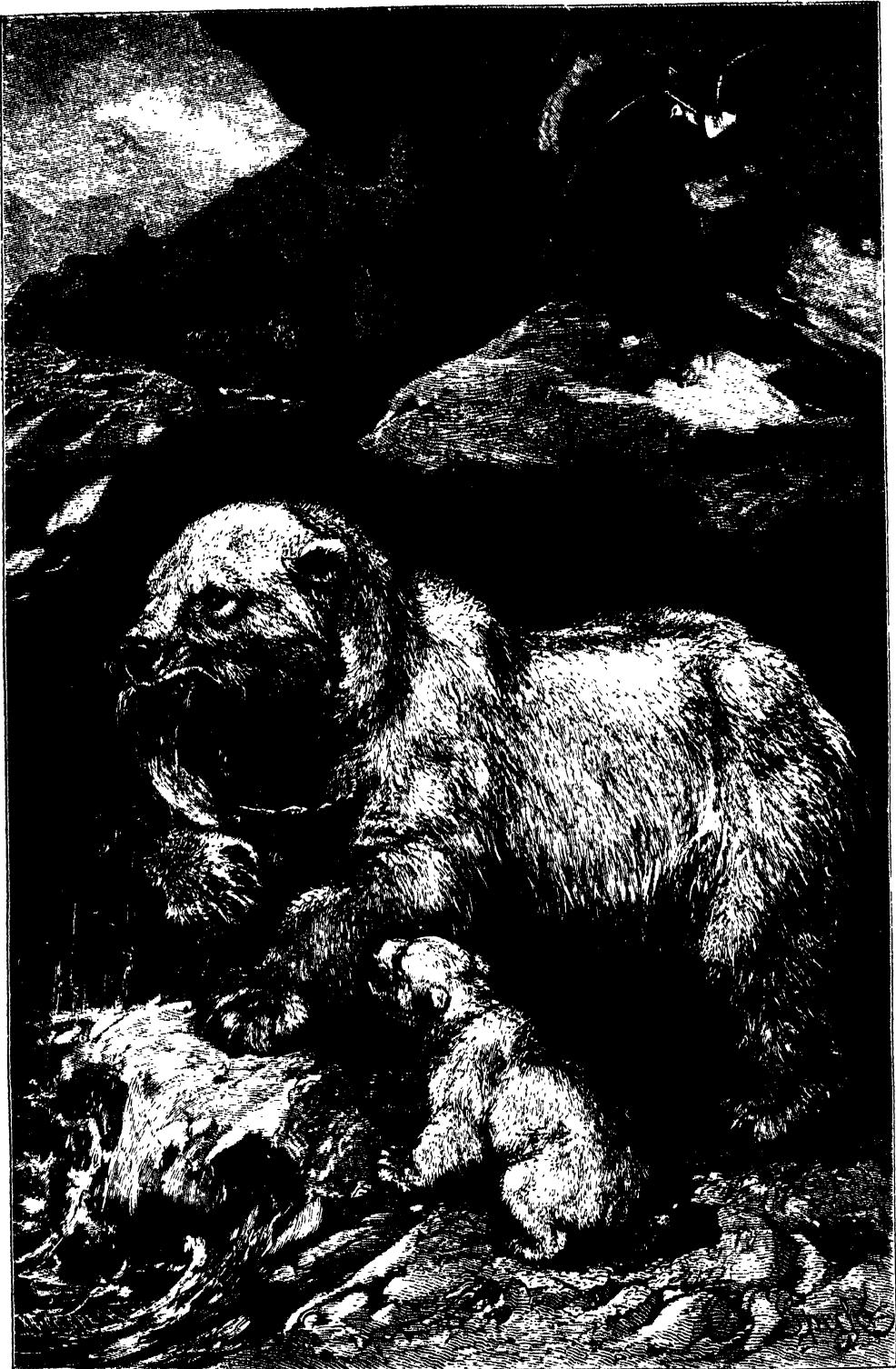
In Nordenskiöld's opinion it is uncertain if the Polar bear hibernates, although there are several circumstances indicating that it probably does so. In the most northerly wintering-stations of ships, the bears almost completely disappear during the long arctic winter, while there are cases where some of them have been found concealed in holes. It will, however, be obvious that this disappearance from the more northern regions in winter may well be due to migration, while the individuals found in concealment may all have been females, which are known to bring forth their young beneath the snow. Other writers, as we shall see below, definitely state that in many districts males and young cubs are to be

found in active life throughout the winter; but it is quite possible that in the most northern portions of its range both sexes may habitually hibernate. According to Eskimo accounts, the female bears are very fat at the time they retire beneath the snow. During their extended excursions after prey, the male and the female, the latter generally attended by one or two good-sized young ones, keep each other company. More are seldom seen together, unless at places where many carcases of walruses, seals, or white whales are lying. Formerly the sight of a bear created dismay in Arctic travellers, but now the walrus-hunters do not hesitate a moment to attack, lance in hand, considerable numbers of bears. The bear's principal food consists of the seal and walrus. There is not the least doubt, continues Nordenskiöld, "that, along with flesh, the bear also eats vegetable substances, as seaweed, grass, and lichens. The flesh of the bear, if he is not too old or has not recently eaten putrid seal-flesh, is very eatable, being intermediate in taste between pork and beef. The flesh of the young bear is white, and resembles veal." In addition to seals and walruses, the Polar bear also subsists on the flesh of certain Cetaceans, and our illustration represents a female carrying a porpoise in her mouth. In some districts the Polar bear consumes a large quantity of fish, more especially salmon. It is in summer that it resorts to a vegetable diet.

From the personal experience of Dr. Robert Brown it appears that the accounts given by the older voyagers of the ferocity of the Polar bear were considerably exaggerated, although at close quarters it is a formidable foe. "Unlike its congeners," writes Dr. Brown, "it does not hug but bites; and it will not eat its prey till it is dead, playing with it like a cat with a mouse. I have known several men who, while sitting watching or skinning seals, have had its rough hands laid on their shoulders. Their only chance then has been to feign being dead, and manage to shoot it while the bear was sitting at a distance watching its intended victim. Though Eskimo are often seen who have been scared by it, yet, unless attacked or rendered fierce by hunger, it rarely attacks man. During our last trip to Greenland none of our party saw one; indeed, they are only killed in the vicinity of Disco Bay during the winter or spring, when they have either come or drifted south on the ice-floes."

Much the same account is given by Mr. G. S. M'Tavish, of the Hudson's Bay Company, who states that in his district it is only occasionally that a Polar bear will attack first. This observer writes that "although the Polar bear is synonymously termed the white bear, they are not all white. Those that are most likely to run away from the hunter are pure white. From the smallest to the largest size these white bears are timid, and I have noticed, on their being killed, they are the fattest. The most dangerous and aggressive kinds, other than females with cubs, is the large-sized male bear of a yellowish, dirty colour. . . . Another sort is the small-sized bear, of both sexes, neither white nor yellow, but rather dirty-looking; and these are likewise the best runners."

Mr. M'Tavish proceeds to observe that the pace of a Polar bear is considerable, and that he has known instances where they have overtaken and killed Indians in a fair chase. Their fleetness depends, however, largely upon their condition at the time, the thinner they are the greater being their speed. The weight of a large and fat Polar bear is estimated at from 600 to 700 lbs.



POLAR BEARS AND THEIR PREY.

In the Hudson's Bay district, the female bears proceed to their winter hibernation for the purpose of producing their young at the end of September or beginning of October, and return in March, April, or May. The hibernation always takes place some distance inland, and the males accompany their consorts to their resting-places, after which they come back to the coast, where they hunt throughout the winter. Generally two cubs are produced at a birth, but the number may be sometimes diminished to one, and occasionally increased to three.

Mr. M'Tavish gives the following account of the manner in which these bears capture their prey:—"The bear having discovered a seal asleep on an ice-floe immediately slips into the water if he himself be on another ice-floe. Diving, he swims under water for a distance, then reappears and takes observations. Alternately diving and swimming, he approaches close to his victim. Before his final disappearance he seems to measure the intervening distance, and when he next appears it is alongside of the seal. Then, either getting on the ice, or pouncing upon the seal as it tries to escape, he secures it. Both seals and porpoises are not unfrequently met with, bearing the marks of a bear's claws upon their backs."

THE BROWN BEAR (*Ursus arctos*).

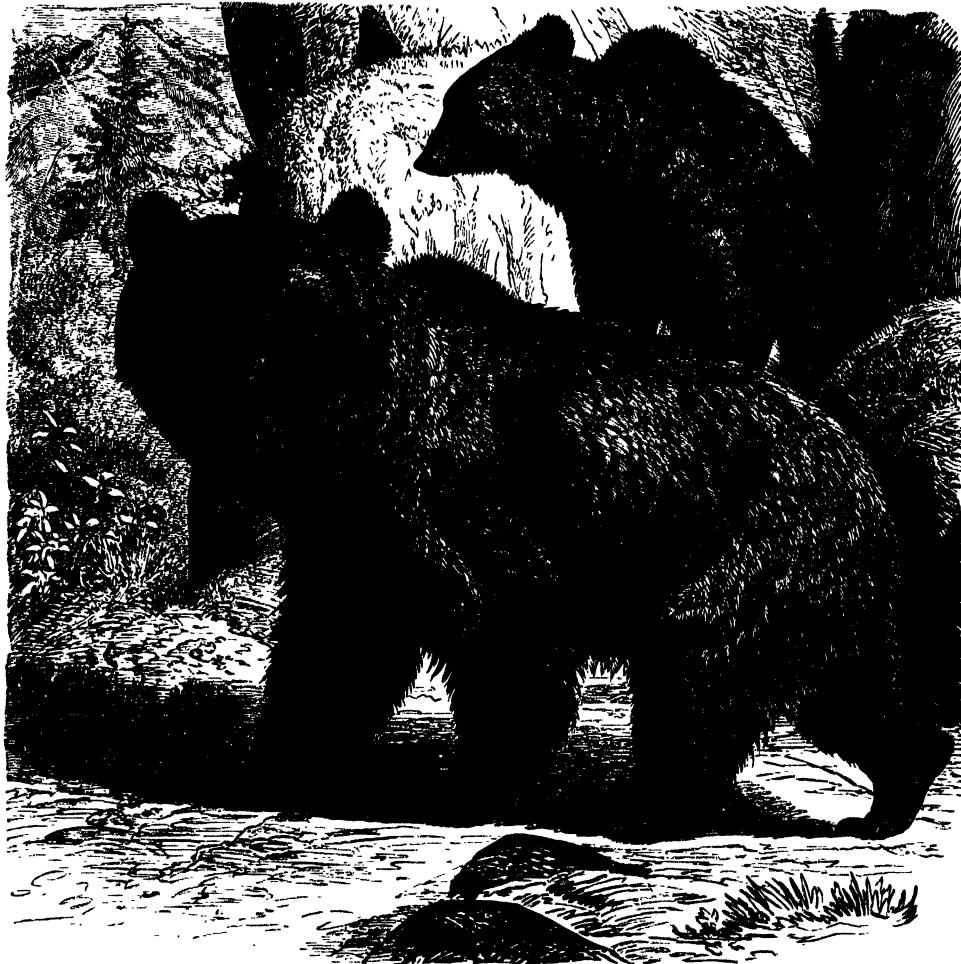
With the brown bear we come to the typical and best known representative of the entire group. It is distinguished from the Polar bear, not only by its colour, but also by its larger and wider head, in which the muzzle is shorter, the profile more curved, and the ears larger. The neck is also shorter and thicker, the teeth are relatively larger, and the soles of the feet are entirely naked.

Owing to variations in colour several so-called species, such as the Syrian bear and the snow or isabelline bear of the Himalaya, have been established on what are now known to be merely local races of the brown bear.

Including all these varieties, the brown bear may be described as one of the largest species of the genus, furnished in winter with long, thick, shaggy, and soft fur, beneath which is a thick and woolly under-fur; the ears being of moderate size, and covered with long hair. The colour is generally some shade of brown, although subject to great individual and local variation. In general it varies from very pale to very dark brown, some of the lighter varieties being almost cream-coloured in certain parts; while, in a variety from Eastern Tibet, the fur on the back and limbs is blackish, with tawny tips to the hairs. In other varieties, again, the fur has a silvery tinge, owing to the hairs being tipped with white; while some specimens have a decidedly reddish tinge. In the light Himalayan variety the colour deepens with age, this darkening being generally most developed in old males, which are frequently indistinguishable in colour from the ordinary European form. Young animals have a white collar on the throat, traces of which may frequently be observed in the newly-grown fur of the adult. The summer coat is much shorter and thinner than the winter dress, and is likewise darker in colour. The claws are of moderate length, and their colour varies from brown to nearly white.

Mr. Blanford suggests that the generally lighter colour of the Himalayan

brown bear may be due to the circumstance that it inhabits more open ground than the European variety. To this I would add that the silver-barked birch, among which these bears are so often found, suggests another reason why their colour should so generally be comparatively light, as among such surroundings a dark animal would be conspicuous. Moreover, it may be that the snow lies longer on the ground in the regions frequented by the Himalayan bear than is the



THE BROWN BEAR ($\frac{1}{2}$ nat. size).

case in the habitats of the European bear. It should also be mentioned that Himalayan bears are decidedly lighter when they issue from their winter sleeping-places than they are later on in the season; and as it is then that they are generally shot, on account of the fur being in its best condition, the prevalent idea as to their extremely light colour has been intensified.

Although, as in the other species of the genus, the males are considerably larger than the females, there is nearly as much variation in point of size in the brown bear as there is in respect of colour. As a rule, the Himalayan race is

smaller than the European. Exact measurements of large European examples are not easy to obtain, but it is probable that some specimens reach at least 8 feet from the tip of the snout to the root of the tail. In the Himalaya the same dimensions are not generally more than 5 or $5\frac{1}{2}$ feet, but large specimens reach about 7 feet, and one has been recorded of $7\frac{1}{2}$ feet in length and 3 feet 5 inches in height. The tail does not measure more than 2 or 3 inches.

The brown bear may be regarded as an inhabitant of almost the whole of Europe, and of Asia northwards of the Himalaya; its former range extending from the British Islands and Spain in the west to Kamschatka in the east. Bears are still found in the Pyrenees, and are comparatively common in many parts of Scandinavia, Germany, Hungary, and Russia. At what date they finally disappeared from the British Islands cannot be determined. Mr. Harting, however, adduces evidence to show that bears were still in existence in the eighth century; and, in the time of Edward the Confessor, the town of Norwich had to furnish annually one bear to the king. There is no decisive historical evidence as to the existence of bears in Ireland, but remains have been found there in various parts, which in all probability belonged to the present species, although they have been referred by some to the American grizzly bear.

In the Himalaya the brown bear is found from Afghanistan in the west to Nipal in the east. It does not occur in the more or less Tibetan districts of Zanskar and Ladak, but extends up the valley of the Indus as far as Gilgit. In the mountains around the valley of Kashmir brown bears were once very numerous, but they have, I believe, become much rarer now. When I first knew Kashmir, in 1874, it was no uncommon event in the Tilel district to see several at once, when standing on a mountain ridge; but eight years later I saw but very few the whole time I was there, and it would be interesting to hear the reports of sportsmen who have recently visited Tilel and the neighbouring valleys.

In Kamschatka, Dr. Guillemard, in the *Cruise of the Marchesa*, speaks of brown bears being extremely plentiful and attaining large dimensions. The country near the rivers is there covered by an almost impenetrable jungle, but the bears manage to force themselves through it without much apparent difficulty. "Just inside the forest," writes Dr. Guillemard, "at a distance of six or eight feet



HEAD OF BROWN BEAR. (From Scaler, *Proc. Zool. Soc.* 1867.)

from the river-bank, is a firmly-trodden path some two feet in width, made entirely by these animals; and, as these paths are to be found without a break on either side of the river in its whole course through the forest country—a distance of about five hundred miles—it will be understood why bears' skins do not command a very high price in the peninsula."

The brown bear is a comparatively unsociable animal, though not unfrequently a male and a female may be seen together, while the females are, of course, accompanied by their cubs. Their favourite haunts are wooded, hilly districts. In the Himalaya the brown bear is to be found at considerable elevations, in the spring haunting the higher birch and deodar forests, while in the late summer it ascends to the open grass-lands above, where it may not unfrequently be seen grazing close to herds of ponies and flocks of sheep or goats. Both in these regions, and the colder districts of Europe and Northern Asia, these bears regularly hibernate; and while they are extremely fat at the commencement of their winter sleep, they are reduced to little more than skin and bone at its conclusion. In the Himalaya the winter's sleep generally lasts till April or May, but varies somewhat in different districts according to the date at which the snow melts. The cubs are generally born during the latter part of the hibernation, and accompany the mother when she issues forth. They are almost invariably two in number, and are born blind and naked, in which condition they remain for about four weeks. In Europe the brown bear not unfrequently kills and eats other animals, its depredations extending, it is said, even to cattle and ponies; but in the Himalaya, except when carcases come in its way, the animal is almost exclusively an insect and vegetable feeder. There it is fond of the numerous species of bulbous plants growing on the mountains around Kashmir; but it will also descend into the orchards of the upland villages to plunder the crops of mulberries, apricots, walnuts, etc. On such occasions it ascends the trees readily enough, although it is by no means such a good climber as its cousin the Himalayan black bear. It seeks for insects by overturning stones.

In Kamtschatka the brown bear is stated to subsist for a certain portion of the year upon salmon; Dr. Guillemard observing that in some places he met with numerous half-eaten fish left by the bears, and adding that he found in almost every instance that "though the head had been crunched up, it had, together with the tail and intestines, invariably been rejected. We were never fortunate enough to witness these animals fishing, but we were told that they walk slowly into the water, where it is about eighteen inches in depth, and, facing down stream, motionless await their prey. The incautious fish, swimming heedlessly up the river, doubtless mistake the bear's broad legs for a rock or tree-stump, and those who have once witnessed the almost lightning-like rapidity of a stroke from Bruin's fore-paws will have no difficulty whatever in completing the drama for themselves. The fish is apparently always taken to the bank to be devoured, for even the small ones do not appear to be eaten whole."

As we have already had occasion to mention, the brown bear, in common with its relatives, is dull of hearing, and it is also by no means well gifted as regards sight. What it lacks in these respects it makes up for, however, in the great development of the sense of smell. Owing to this deficiency of hearing, a bear can

be approached from the leeward to within a very short distance, and the writer has shot many in the Himalaya with a smooth-bore gun. Care should, however, always be taken to approach a bear from above, as a wounded one rolling down hill on to the hunter is a very dangerous object.' If two bears are feeding together and one is hit by a bullet, it will not unfrequently turn fiercely on its companion, apparently under the impression that the latter was its aggressor. In the Himalaya, at least, the brown bear never voluntarily attacks human beings if unmolested, and it rarely turns on them when wounded, unless brought to close quarters. There is but little doubt that the current stories of the fierceness of the European bear are exaggerated. In regard to the proverbial "hug," Mr. Blanford observes that the story is apparently devoid of foundation. "A bear, from its anatomical structure, strikes round with its paws, as if grasping, and the blow of its powerful arm drives its claws into the body of its victim, causing terrible wounds, but the idea of its 'hugging' appears not confirmed by recent observers."

At the best, a brown bear is uncouth and grotesque in its movements, and in no case is this more marked than when one of these animals suddenly catches a whiff of human scent, and starts off with a loud "whuff" at a shambling gallop. In spite, however, of their uncouthness, bears can travel pretty quickly when so minded, although their usual gait is deliberate in the extreme.

The brown bear is easily tamed, and both in Europe and India is the companion of itinerant showmen, by whom it is taught to dance, and go through various other performances. Formerly native English bears, and subsequently foreign ones imported for the purpose, were kept in England for the purpose of "bear-baiting," and the office of Master of the Bears was a Crown post, while every nobleman kept his "bear-ward." Bear-baiting was continued up to the reign of Queen Anne. The well-known bear-garden at Berne in Switzerland is doubtless a survival of the mediæval establishments kept up for this so-called sport. As showing the age to which the brown bear may live, it is worthy of mention that one kept in the garden at Berne survived for upwards of forty-seven years, while it is on record that a female gave birth to young at the age of thirty-one years. From the beauty of their colour, and the length of their fur, the skins of the Himalayan brown bear, if procured early in the spring, are held in high estimation.

We have already mentioned that fossil remains, referred to the brown bear, have been found in the superficial deposits of Ireland; and it may be added that bones and teeth undoubtedly belonging to this species occur in the fens, brick-earths, and caverns of this country, as well as the corresponding deposits of the continent. Whether the remains from the same formations that have been assigned to the grizzly bear do not likewise belong to the European species, may, we think, be a subject of doubt.

Crowther's bear (*U. crowtheri*) is a closely-allied if not identical form from the Atlas Mountains, and it is probable that a bear exists in Morocco and Algeria which may be either the common brown bear or Crowther's bear, if the latter be distinct.

THE GRIZZLY BEAR (*Ursus horribilis*).

The gigantic grizzly bear of Western North America, whose range extends from Alaska through the Rocky Mountains to Mexico, is generally regarded as a species distinct from the brown bear, although there can be no question but that the two are very closely related. There are, however, some slight differences in the characters of the skull and cheek-teeth in the two forms, while the grizzly bear is generally larger in size, greyer in colour, and has shorter and less valuable fur than its European cousin. Some of the brown bears from Northern Asia are probably nearly or quite as large as an average-sized grizzly; while the difference in this respect between brown bears from different districts indicates that mere size cannot be a matter of much importance. All the American hunters recognise several varieties of greyish bears, respectively known as the "silver-tip," "roach-back," and the "barren-ground" bear, in addition to the typical grizzly; and Dr. Hart Merriam is disposed to regard the last as a distinct species, under the name of *U. richardsoni*. We prefer, however, to adopt the view that there are but two distinct species of North American bears. Occasionally, as in the case of the black bear, there may be cinnamon-coloured varieties of the grizzly; and it was at one time considered that such yellow-haired bears constituted a distinct species—the so-called cinnamon bear (*U. cinnamomus*), but it is now known that such coloration is merely a phase common to each species. Dr. W. S. Rainsford states, indeed, that he has seen a female grizzly with three cubs, of which one was almost yellow, a second nearly black, and the third grey. The so-called barren-ground bear of Arctic America is stated to come very close to the European brown bear, and may indeed prove to be the connecting link between it and the typical grizzly. Whether, then, the grizzly bear be rightly regarded as a distinct species, or whether it be merely a well-marked race of the brown bear, we take it to include all the grey and brownish bears of North America. In addition to this wide range in colour, there are considerable differences in form. Thus some have a well-marked hump at the back of the head, extending to the shoulders, which is totally wanting in others; while the width of the sole of the hind-foot is subject to great individual variation.

The accounts of the size and weight of the grizzly are very **Dimensions.** discrepant, and have probably been much exaggerated; most of the measurements having been taken from pegged-out skins, while the weights are mere estimates. It is said that the finest grizzlies hail from Alaska, but it is probable that those formerly inhabiting the Pacific flanks of the high Sierra Nevada were really the largest. These, however, have been nearly or completely exterminated by the shepherds, who poisoned them on account of the ravages they committed on their flocks. These Sierra grizzlies are reported to have been of the enormous weight of 1800 lbs.; and there seems no doubt that instances of 1400 and 1200 have been reached. Dr. Rainsford states, however, that he estimates the weight of the largest grizzly with which he was acquainted at 1000 lbs., and gives 900 lbs. as that of an unusually large male. The skin of this animal measured 9 feet 3 inches from the nose to the hind-foot, when pegged out without undue stretching; another skin measured in the same manner reached



THE GRIZZLY BEAR.



10 feet, while a third was still larger. Unfortunately the length from the nose to the root of the tail is not given, but it is probable that in large specimens this must be close on 9 feet.

Distribution. We have already seen that the grizzly is found from Alaska to Mexico; and it may be added that from east to west it reaches from the Coast Range across the Sierra Nevada to the Big-Horn Range in Wyoming, and some distance on to the plains at its foot. Its distribution is, however, becoming gradually more and more restricted. In 1868 bears were to be found on the plains for several hundred miles eastward of the Big-Horn, but they are now rare even in that range itself. Similarly, they have greatly diminished in numbers in Southern California and the parallel valleys of the Coast hills further to the northward.

Habits. That the grizzly bear will eat flesh whenever it has the chance is admitted by all, but there is some discrepancy of opinion as to whether it ever kills large mammals for the sake of their flesh. Thus while Sir Samuel Baker denies that they ever do so, Dr. Rainsford relates a case where his hunter saw a grizzly attack one of three bisons. Wherever wapiti are abundant there will grizzly bears be found. Failing meat, they, according to Dr. Rainsford, thrive on nuts, acorns, etc.; "and," he says, "the fattest grizzlies I ever killed were those that had been feeding for weeks on the pine-nuts that the mountain squirrels stow away in such great plenty in the little colonies on the upper hillsides. Where the nut-pine is plentiful, you may also expect to find bears." The grizzly is a bad climber, and seldom resorts to trees at all. Its strength is, however, prodigious. One has been seen to break the neck of a tall bison with a single blow of its paw; another has bodily carried off, over very rough ground, a male wapiti, weighing nearly 1000 lbs.

Sir Samuel Baker states that a frequent practice in bear-shooting is to kill several deer, and leave them untouched on the ground as baits. "At daybreak on the following morning the hunter visits his baits, and he will probably find that the bears have been extremely busy during the night in scratching a hole somewhat like a shallow grave or trench, in which they have rolled the carcase; they have then covered it with earth and grass, and in many cases the bears may be discovered either in the act of working, or, having completed their labour, they may be found lying down asleep, half gorged with flesh."

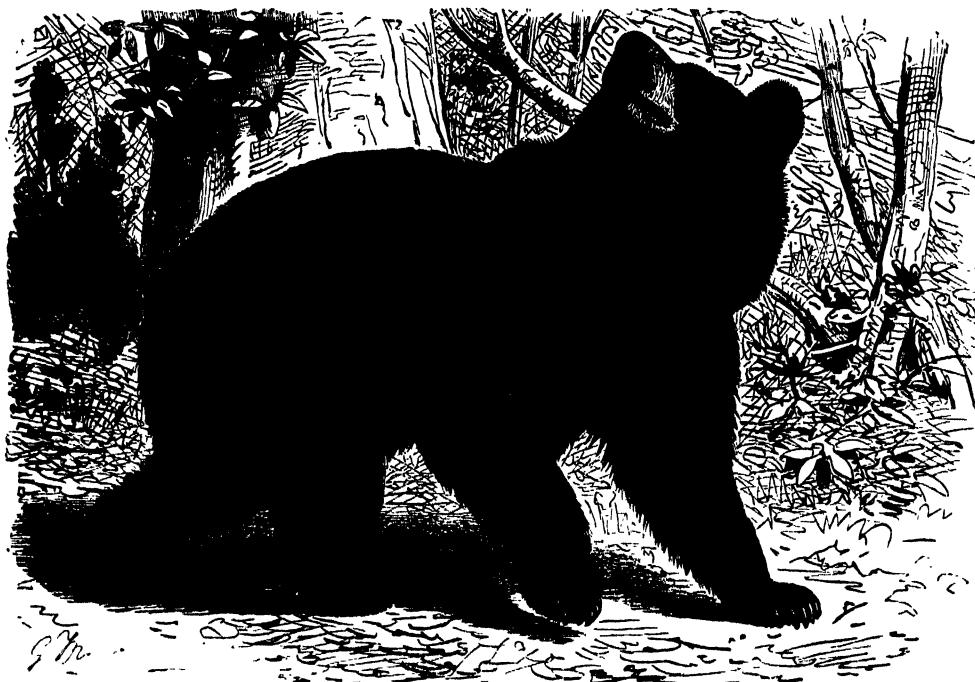
In the northern part of its range the grizzly bear hibernates, but it is probable that in the south it remains active throughout the winter. When it first comes out in the spring, it has a habit of standing upright against a pine or other tree and scoring its bark with its claws. Very incorrect conclusions have been drawn from these marks as to the size of the bears by which they were made, it having been forgotten that the animals were generally standing on from three to five feet of snow when they thus scored the trees.

The grizzly has been accredited with extreme ferocity towards man; but, granting that its great strength and extreme tenacity of life make it a most formidable foe when brought to close quarters, Dr. Rainsford is inclined to think that there has been considerable exaggeration on this point, and many of the stories of these animals charging is due to their rolling downhill upon the hunter who

has incautiously fired at them from below instead of from above. The same writer also considers that at the present day Winchester repeaters and other rifles have established in the grizzly a wholesome dread of man, and that it is now altogether a more cautious and timid animal than formerly.

THE AMERICAN BLACK BEAR (*Ursus americanus*).

The American black bear is a well-marked species, differing from the brown bear much more decidedly than does the grizzly. It is a smaller animal than the brown bear, from which it differs by the proportionately smaller head, the sharper



AMERICAN BLACK BEAR ($\frac{1}{2}$ nat. size).

muzzle, and more regularly convex profile of the face, as well as by the much shorter hind-foot. In length this bear seldom exceeds 5 feet. The fur is less shaggy, and altogether smoother and more glossy than that of either the brown or grizzly bear; being typically of a uniformly black colour, except on the muzzle, where it becomes tawny yellow. Occasionally, however, specimens are found with white margins to the lips and white streaks on the chest. The smaller size of the hind-feet of this species renders its trail distinguishable at a glance from that of the grizzly bear. As already mentioned, the so-called cinnamon bear may be a pale-coloured variety, either of the black bear or of the grizzly.

The black bear formerly had a wider distribution than the grizzly, extending from Labrador and Canada to the Gulf of Mexico, and from the east to the west coasts of the continent. Colonel D. G. Alexander states that it frequented "all

the mountains, the thickets of the vast plains, and every creek, river, and bay or bottom. At the present day its habitat is, however, confined to some portions of the various ranges of mountains south of the St. Lawrence River, the Great Lakes, and, east of the Mississippi River, to parts of those portions of the Mississippi River and its tributaries which are yet unsettled, and where it has been able to escape destruction from hunters. Some few are yet found in the dense thickets of the Colorado, Trinity, and Brazor rivers." As with other bears, the male of this species is much larger than the female; when full grown the former, according to Colonel Alexander, will stand about 3 feet in height, and will often turn the scale at from 600 to 700 lbs.

According to Dr. Merriam, the food of the American black bear "consists not only of mice and other small mammals, turtles, frogs, and fish, but also, and largely, of ants and their eggs, bees and their honey, cherries, blackberries, raspberries, blueberries, and various other fruits, vegetables, and roots. He sometimes makes devastating raids upon the barn-yard, slaying and devouring sheep, calves, pigs, and poultry." Another writer, Mr. C. C. Ward, states, as the result of his own experience, that the black bear "is growing more carnivorous and discontented with a diet of herbs. Assuredly, he is growing bolder. He is also developing a propensity to destroy more than he can eat, and it is not improbable that his posterity may cease to be frugi-carnivorous. It is fortunate that an animal of the strength and ferocity which he displays when aroused seldom attacks man. The formation of his powerful jaws and terrible canine teeth are well adapted to seize and hold his prey, and his molars are strong enough to crush the bones of an ox. His great strength, however, lies in his fore-arms and paws. His mode of attacking his prey is not to seize it with his teeth, but to strike terrific blows with his fore-paws. His weakness is for pork, and to obtain it he will run any risk. When the farmers, after suffering severe losses at his hands, become unusually alert, he retires to the depths of the forest and solaces himself with a young moose, caribou, or deer. He seldom or never attacks a full-grown moose, but traces of desperate encounters, in which the cow-moose has battled for her offspring, are frequently met with in the woods." Dr. Merriam states that the black bears visit the Adirondacks from the wooded districts about twenty miles to the westward in Lewis County during the autumn, crossing a fertile and well-cultivated valley. They are good climbers, but, from their weight, are unable to ascend to the tree-tops or climb far out on the branches, although they will ascend straight stems for a considerable height after honey. They are also excellent swimmers, many being killed while swimming in the lakes. We likewise learn that, as a rule, the black bear hibernates, although its torpor is not deep, and the time of entering upon the winter repose depends upon the severity of the season, and the amount of food-supply. And it appears that the males will remain active in any weather, so long as they can find abundance of food. The female is, however, compelled to seek shelter sooner on account of her prospective family. The winter den of a black bear is generally a partial excavation under the upturned roots of a fallen tree, or beneath a pile of logs, with perhaps a few bushes and leaves scraped together by way of a bed, while to the first snowstorm is left the task of completing the roof and filling the remaining chinks. Not unfrequently

the den is a great hole or cave dug into the side of a knoll, and generally under some standing tree, whose roots serve as side-posts to the entrance. The amount of labour bestowed upon it depends upon the length of time the bear expects to hibernate. If the prospects point towards a severe winter, and there is a scarcity of food, they "den" early, and take pains to make a comfortable nest; but when they stay out late, and then "den" in a hurry, they do not take the trouble to fix up their nests at all. At such times they simply crawl into any convenient shelter without gathering so much as a branch of moss to soften their bed. Snow completes the covering, and as their breath condenses and freezes into it an icy wall begins to form, and increases in thickness and extent day by day till they are soon unable to escape, even if they would, and are obliged to remain in this icy cell till liberated by the sun in April or May.

The young are born about January or February, and are usually two or three in number, although four have been found in a litter. It is believed that the female does not give birth to young oftener than every alternate year.

The black bear was pursued by the early colonists of North America by "still-hunting," or what would be called in England stalking; and it appears that this requires much more care than in the case with other bears, since the American black bear is very acute of hearing. A favourite expedient was to watch a herd of pigs in the cultivated districts, upon which the bears would make a raid, and could then be shot with ease. Mr. C. C. Ward writes that "sometimes the black bear is hunted with dogs trained for the purpose. The dogs are not taught to seize the bear, but to nip his heels, yelp around him, and retard his progress, until the hunters come up and despatch him with their rifles. Common yelping curs possessed of the requisite pluck are best adapted for the purpose. Large dogs with sufficient courage to seize a bear would have but a small chance with him, for he could disable them with one blow of his powerful paw. Another way of hunting is to track Bruin to his winter den, and either smoke or dig him out, when he may be despatched by a blow on the head with the pole of an axe as he struggles out. Various kinds of traps, set-guns, and dead-falls are also employed against him."

THE HIMALAYAN BLACK BEAR (*Ursus torquatus*).

With the black bear of the Himalaya we come to a very different animal, readily recognised by the white chevron or inverted crescent on the chest, from which it takes its scientific title, and which stands out in marked contrast to the jetty black of the remainder of the fur. This species does not attain by any means such large dimensions as the brown or grizzly bear; the length from the tip of the snout to the root of the tail usually averaging in Nipalese examples from about $4\frac{1}{2}$ to $5\frac{1}{2}$ feet, although one specimen has been recorded measuring 6 feet 5 inches. We think, however, that bears of this species from Kashmir would average somewhat larger.

The fur is very different to that of either of the three preceding species, being short and smooth, without any under fur, and becoming very thin in summer. In winter the hair on the shoulders becomes considerably elongated, so as to produce the appearance of a kind of hump. The ears are relatively large, and covered with rather long hair. In addition to the white mark on the chest, the chin is also

white; while the upper lip may be whitish, and the nose reddish-brown. The claws are comparatively short, and black in colour.

Mr. Blanford gives the weight of full-grown males as varying from 200 to 250 lbs.; but these weights are probably exceeded in autumn, when the Himalayan



THE HIMALAYAN BLACK BEAR ($\frac{1}{16}$ nat. size).

black bear becomes enormously fat, the thickness of the fat on the haunches reaching several inches. At such seasons the skin—never very valuable—becomes utterly useless, from being saturated with oil. The skull of this bear has a relatively shorter muzzle and a longer portion behind the eye than that of the brown bear; from which it may also be distinguished by the slight development of the bony ridge along the middle of the brain-case.

The Himalayan black bear is an exclusively forest-dwelling animal, except in Baluchistan, where it inhabits open country. Its range extends from about the eastern portion of Persia through Baluchistan into Afghanistan and Sind; and thence through the forest-clad portions of the Himalaya to Assam, and so on into Burma. The species is also found in the south of China and the islands of Hainan and Formosa, but in Ladak and Tibet it is quite unknown.

The black bear may be found in the Himalaya, from near the foot

Habits. to elevations of some ten thousand to twelve thousand feet in summer.

It is, perhaps, most abundant in the dense chestnut and oak woods surrounding the valley of Kashmir, whence it issues forth at night to make extensive depredations on the crops and orchards of the natives. Although, according to General Kinloch, the black bear will at times take to killing sheep, cattle, and ponies, it is, as a rule, a vegetable feeder. In the forest the chief food of these bears consists of chestnuts, acorns, roots, berries, ants, and honey. Whenever they raid the cultivated grounds, they consume maize, rice, buckwheat, and a number of fruits, such as mulberries, apples, pears, apricots, and walnuts—the latter being especial favourites. The gourds and melons which are cultivated in many of the gardens in Kashmir are also sometimes eaten by these bears. So numerous are they that it is by no means unfrequent to see two, three, or even more, up a single fruit tree in some of the less frequented districts of Kashmir. They are, indeed, excellent climbers; and their short claws are much better adapted for this purpose than for digging. When in the forests they may be stalked during the day with comparative ease, and will generally be found feeding on roots or wild fruits. This sport, as the writer can state from personal experience, is by no means very exciting, as they are easy of approach. Another method of hunting is by beating small patches of jungle on the hills—from below upwards—when the bears will be driven out. They very frequently go in family parties, comprising the two parents, the two youngest cubs, and one or perhaps two cubs of the preceding litter. When driven from the forest, the whole party emerges in single file, headed by the male, who is followed by the female, after which come the cubs according to seniority. They always break cover with the usual deliberate and sober pace characteristic of all bears, and when the party comprises five or six individuals the sight is ludicrous in the extreme.

The black bear, which is known in Kashmir as the Siyah Haput (in contradistinction to the Kunea Haput, or brown bear), does not thoroughly hibernate, but, according to General Kinloch, "appears to pass a great deal of his time during the cold months in a state of semi-torpor; occasionally wandering out in search of food, when an unusually mild day thaws his blood and awakens him to the sense of hunger."

Like its similarly-coloured relative in North America, the black Himalayan bear is sharper in hearing than the brown bear, and it may be that the black coloration has some connection with the greater development of this sense. In disposition the black bear is decidedly more savage and prone to attack man than the brown bear; and in the fruit-season a large number of natives are annually badly mauled in Kashmir by its talons. It must be confessed, however, that these wounds are largely due to the foolhardiness of the natives themselves, who will

not hesitate to drive off the bears from their crops and orchards when armed solely with a stick. In addition to its skill as a climber this bear is a good swimmer. The young, which are nearly always two in number, are born in the spring.

Allied Forms. The small variety from Baluchistan, locally known as the Mam, and originally described as a distinct species, under the name of *U. gedrosianus*, is chiefly interesting as inhabiting a country of such a totally different nature from the typical habitat of the present species. The Japanese black bear (*U. japonicus*) is so nearly allied to the Himalayan species that it is regarded by some writers merely as a local variety, mainly characterised by the white mark on the throat being less distinct. It appears to be very common in Northern Japan, where it is of great importance to the Ainos, who use its skin for clothing, its flesh for food, and the stones in its gall-bladder for medicine. Aino houses are commonly decorated with the skulls of these bears; and, according to Miss Bird, "the Ainos may be distinguished as bear-worshippers, and their great religious festival, or saturnalia, as the Festival of the Bear. . . In all Aino houses, specially near the chief's house, there are several tall poles with the fleshless skull of a bear on the top of each; and in most there is also a large cage, made gridiron fashion of stout timbers, and raised two or three feet from the ground. At the present time such cages contain young but well-grown bears, captured when quite small in the early spring. After the capture the bear cub is introduced into a dwelling-house, generally that of the chief or sub-chief, when it is suckled by a woman, and played with by the children, till it grows too big and rough for domestic life, and is placed in a strong cage, in which it is fed and cared for, as I understand, till the autumn of the following year, when, being strong and well-grown, the Festival of the Bear is celebrated. The customs of this festival vary considerably, and the manner of the bear's death differs among the mountain and coast Ainos; but everywhere there is a general gathering of the people, and it is the occasion of a great feast, accompanied by much *saké*, and a curious dance, in which men alone take part. Yells and shouts are used to excite the bear, and when he becomes much agitated a chief shoots him with an arrow, inflicting a slight wound which maddens him, on which the bars of the cage are raised, and he springs forth, very furious. At this stage the Ainos run upon it with various weapons, each one striving to inflict a wound, as it brings good luck to draw his blood. As soon as he falls down exhausted, his head is cut off, and the weapons with which he has been wounded are offered to it, and he is asked to avenge himself upon them. Afterwards the carcase, amidst a frenzied uproar, is distributed among the people, and amidst feasting and riot the head, placed upon a pole, is worshipped, i.e. it receives libations of *saké*, and the festival closes with general intoxication." In another part of the country the neck of the bear is broken by means of a pole placed across it, upon which a number of men bring their weight together. Somewhat similar customs used to take place in Norway when a brown bear was killed.

The Spectacled Bear. The spectacled bear of the Peruvian Andes (*Ursus ornatus*), which is the sole representative of the family inhabiting South America, is a small-sized black species, which derives its name from the tawny

rings or semicircles round the eyes, whereby a most grotesque appearance is communicated to the whole physiognomy. The jaws, cheeks, throat, and chest are white; and the whole length of the animal is only about $3\frac{1}{2}$ feet. It has been generally considered that this bear is nearly related to the next species; but, although specimens have been exhibited in the London Zoological Society's Gardens, little or no information exists as to its habits in the native state.



THE MALAYAN BEAR ($\frac{1}{2}$ nat. size).

The Malayan Bear. The small black Malayan bear (*Ursus malayanus*) is a very well-marked species, distinguished by its small and rounded ears, covered with short hair, its much elongated and almost prehensile tongue, its very short and wide molar teeth, and the shortness and breadth of the skull, in which

the nose is but slightly produced. The claws are considerably curved, and pale in colour. The fur of this species is very short and coarse, and is mostly black, although tending to brown in some parts; the whole of the muzzle is paler, or whitish, and the light band on the chest varies from white to orange, and is subject to considerable diversity of form, sometimes extending as a streak on to the under-part of the body. The general length of the head and body is only about 4 feet, and, according to Mr. Blanford, never exceeds $4\frac{1}{2}$ feet. A female mentioned by the same writer, although fully adult, had a length of only $3\frac{1}{2}$ feet, and did not weigh more than 60 lbs. This species is found in the Malay Peninsula, and the islands of Sumatra, Java, and Borneo, and also extends through Burma into the Garo Hills in North-Eastern India. Of its habits, Mr. Blanford states that little is known except in captivity. It is a purely forest animal, and an admirable climber. It is essentially frugivorous, but like other bears occasionally kills and eats mammals and birds. It is said to be very fond of honey, and it probably devours insects and larvae. When caught young, it is generally easily tamed, and is usually gentle and amusing when in captivity. Its general pace is much quicker than that of other bears, and a specimen kept some years ago in the Zoological Gardens at Calcutta, used to pace up and down its cage with great rapidity, turning very suddenly every time it came to the end of its track. A fragment of the jaw of an extinct bear, obtained from the gravels of the Narbada Valley, in India, appears to indicate a more or less closely allied species.

THE EXTINCT CAVE-BEAR (*Ursus spelæus*).

No account of the typical bears would be complete without some reference to the great extinct cave-bear, of which the remains are found in such profusion in the caverns of Europe, and less commonly in the brick-earths and other superficial deposits. This gigantic species, of which the skull is represented in the annexed figure, was a contemporary of the mammoth and early human inhabitants of Europe. The skull is readily distinguished from that of all other species by the great prominence immediately above the eyes; while the molar teeth are characterised by the extremely fine tuberculation of their crowns, in which, when unworn, the enamel has a kind of wavy pattern.

The cave-bear, although it had a wide range in Europe, is unknown both in the extreme north and the extreme south of that continent; it is found in the British Isles as far north as Yorkshire, but is not definitely known to occur in Ireland. The number of individuals inhabiting Brixham Cave, near Torquay, and



SIDE-VIEW OF SKULL OF CAVE-BEAR.

the celebrated cavern of Gailenreuth in Franconia, must have been prodigious, although it will be obvious that all of these did not exist at one time. From its size, which exceeded that of the largest grizzly, as well as from its numbers, it must have been a formidable foe to the early hunters of Europe, armed only with flint hatchets and spears. In the earlier Pliocene deposits of Europe there occur the remains of the Etruscan bear (*U. arvernensis*), which was considerably inferior in size to the brown bear. The extinct Theobald's bear (*U. theobaldi*) from the Siwalik Hills of Northern India, appears to have been a species closely connecting the typical bears with the one next on our list.

THE SLOTH-BEAR.

Genus *Melursus*.

The well-known Indian sloth-bear (*Melursus ursinus*), commonly known in its native country by the name of Bhalu, but by the Mahrattas termed the Aswal, differs so remarkably from all the other members of the family that it is generally regarded as forming a genus by itself. It differs from all the typical bears by having but two pairs of incisor or front-teeth in the upper jaw, so that the total number of teeth is forty instead of forty-two. Moreover, all the cheek-teeth are much smaller in proportion to the size of the skull than in other bears, while the palate of the skull is deeply concave, instead of being nearly flat. The claws are also unusually large and powerful, and the snout and lower lip are much elongated and very mobile. The sloth-bear is, at best, but an ugly-looking animal, and is generally of smaller size and less bulk than the Himalayan black bear. It is covered with very long and coarse fur, which attains its greatest length on the shoulders. With the exception of the end of the muzzle being dirty grey, and of the white chevron on the chest, the colour of the fur is black, but the long claws are white. As regards size, this species measures from about 4½ feet to 5 feet 8 inches in the length of the head and body, the tail generally measuring from 4 to 5 inches, exclusive of the hair; the height at the shoulder varying from 2 feet 2 inches to about 2 feet 9 inches. Large males may weigh as much as 280 lbs., while there is one instance recorded of a specimen weighing as much as 320 lbs.

The sloth-bear may be regarded as one of the most characteristic, and at the same time one of the commonest of the mammals of India. It is found in Ceylon, and in the peninsula of India from Cape Comorin nearly to the foot of the Himalaya. Mr. Blanford states that it ranges as far west as the province of Katiawar, and is also occasionally found in Cutch, while to the northwards its range is probably limited by the great Indian desert. It occurs in North-Eastern Bengal, but how far its range extends in this direction is not fully ascertained, there being some doubt whether the large black bear found in the plains of Assam is this species or the Himalayan black bear. Within the last thirty or forty years it has been completely exterminated from some parts of Bengal and the Deccan.

Habits. Perhaps the best account of the habits of this bear is one drawn up by Mr. Blanford, partly from the results of his own observations and partly from those of others. It is there stated that these bears "are generally



SLOTH-BEARS IN A FOREST GLADE.

K. JAHN MARGOT

found solitary or in pairs, or three together; in the latter case a female with two cubs, often nearly or quite full-grown. Occasionally four or five are met with in company. They inhabit bush and forest, jungle and hills, and are particularly fond of caves in the hot season and monsoon, and also when they have young. Throughout several parts of the peninsula of India there are numerous hills of a granitoid gneiss that weathers into huge loose rounded masses. These blocks remain piled on each other, and the great cavities beneath them are favourite resorts of bears, as in such places the heat of the sun, and some of the insects that are most troublesome in the monsoon can be avoided. In the cold season, and at other times when no caves are available, this animal passes the day in grass or bushes, or in holes in the banks of ravines. It roams in search of food at night, and near human habitations is hardly seen in the daytime; but, in wild tracts uninhabited by man, it may be found wandering about as late as eight or nine o'clock in the morning, and again an hour or even more before sunset in the afternoon. In wet or cloudy weather, as in the monsoon, it will sometimes keep on the move all day. But the sloth-bear, although, like most other Indian animals, it shuns the midday sun, appears by no means so sensitive to heat as might be expected from its black fur, and it appears far less reluctant to expose itself at noonday than is the tiger. I have seen a family of bears asleep at midday in May on a hillside in the sun. They had lain down in the shade of a small tree, but the shade had shifted without their being disturbed. It is scarcely necessary to observe that this bear does not hibernate. Owing to its long, shaggy, coarse fur, its peculiarly shaped head, its long mobile snout, and its short hind-legs, this is probably the most uncouth in appearance of all the bears, and its antics are as comical as its appearance. Its usual pace is a quick walk, but if alarmed or hurried it breaks into a clumsy gallop, so rough that when the animal is going away it looks almost as if propelled from behind and rolled over and over. It climbs over rocks well, and, like other bears, if alarmed or fired at on a steep hillside, not unfrequently rolls head-over-heels down hill. It climbs trees, but slowly and heavily; the unmistakable scratches left on the bark showing how often its feet have slipped back some inches before a firm hold was obtained."

As might have been predicted from the small size and half-rudimentary condition of its molar teeth, the food of the sloth-bear consists almost exclusively of fruits, flowers, and insects, together with honey. Its favourite fruits appear to be those of the ebony tree, the jujube-plum, several kinds of figs, and the long pods of the cassia. Whether grapes, as shown in our illustration, form also part of the diet of these bears, or whether this is merely a fancy on the part of the artist, we are unaware. During the months of February and March, in many parts of India, the beautiful fleshy scarlet flowers of the mowha tree are nightly shed in great profusion, and form a rich feast for many denizens of the jungle, prominent among which is the sloth-bear, by whom these flowers are greatly relished. In addition to beetles and their larvæ, as well as young bees and honey, the sloth-bear is also passionately fond of white ants or termites. On this point Colonel Tickell, as abridged by Dr. Jerdon, observes that "the power of suction in this bear, as well as of propelling wind from its mouth, is very great. It is by this means it is enabled to procure its common food of white ants and larvæ with ease. On arriving at an ant-hill,

the bear scrapes away with the fore-feet until he reaches the large combs at the bottom of the galleries. He then with violent puffs dissipates the dust and crumbled particles of the nest, and sucks out the inhabitants of the comb by such forcible inhalations as to be heard at two hundred yards' distance or more. Large larvæ are in this way sucked out from great depths under the soil. Where bears abound, their vicinity may be readily known by numbers of these uprooted ants' nests and excavations, in which the marks of their claws are plainly visible. They occasionally rob birds' nests and devour the eggs. . . . The sucking of the paw, accompanied by a drumming noise when at rest, and especially after meals, is common to all bears, and during the heat of the day they may often be heard humming and puffing far down in caverns and fissures of rocks."

Like the fox-bats and the palm-civets, the sloth-bear will often visit the vessels hung on the palm-trees for the sake of their juice, and is said frequently to become very drunk in consequence. Sugar-cane is likewise a favourite dainty of these bears, which frequently do a large amount of damage to such crops. Although they generally subsist entirely on vegetable substances and insects, it seems that they will occasionally eat flesh; Sanderson mentioning an instance where one of them devoured the carcase of a recently-killed muntjac deer, the proof that a bear was the devourer being afforded by the imprints of its feet in the wet soil. The same observer also mentions that he has known bears gnaw the dry bones of cattle that have died in the jungle.

With the exception of the puffing and humming noises already mentioned, the Indian sloth-bear is generally a silent animal. Mr. Blanford states, however, that "occasionally they make the most startling noise, whether connected with pairing or not I cannot say. I have only heard it in the beginning of the cold season, which is not their usual pairing-time. They occasionally fight under fruit-trees, but I think the noise then made is rather different."

Like most other members of the family, the sloth-bear has the sense of hearing but poorly developed, and its eyesight is also far from good; and hence it has a peculiarly comical way of peering about when it suspects intruders, as though it were short-sighted. From these deficiencies of sense it can be approached very closely from the leeward side. Its sense of smell, is, however, wonderfully acute, and by its aid it is enabled to detect concealed supplies of honey, and also to scent out ants' nests when situated far below the ground.

The number of cubs produced at a birth is, as in most bears, usually two, but it appears that there may sometimes be three. The young cubs are generally carried on the back of the female when the animals are on the move; and the author last mentioned observes that it is an amusing sight to watch the cubs dismount at the feeding-grounds, and scramble back to their seat at the first alarm. We are informed by Mr. Sanderson that the cubs are carried about in this manner till they are several months old and have attained the dimensions of a sheep-dog, and that when there is room for only one cub on the maternal back the other has perforce to walk by the side.

In regard to their family life, Mr. Sanderson observes that these "bears are exceedingly affectionate animals amongst themselves, and are capable of being most thoroughly tamed when taken young. Either wild or tame they are very amusing

in their ways, being exceedingly demonstrative and ridiculous. Though hard to kill, they are very soft as to their feelings, and make the most hideous outcries when shot at—not only the wounded animal, but also its companions. It has frequently been stated by sportsmen that if a bear be wounded he immediately attacks his companions, thinking that they have caused his injuries. But I think this is not quite correct, at least in the majority of cases. I have observed that a wounded bear's companions generally rush to him to ascertain the cause of his grief, joining the while in his cries, when he, not being in the best of humours, lays hold of them, and a fight ensues, really brought about by the affectionate but ill-timed solicitude of his friends."

In commenting upon the latter portion of this passage, Mr. Blanford supports the old view that the attack is made directly by the wounded animal; and one instance is mentioned where he saw a female when wounded immediately commence an unprovoked attack upon her two half-grown cubs, which were severely cuffed. In another case, when two full-grown bears were both hit, they stood up and fought on their hind-legs, till one fell dead from the effects of the bullet.

Although generally timid in their nature, sloth-bears will on rare occasions attack human beings without provocation, and when they do so, fighting both with teeth and talons, and inflicting terrible wounds, more especially on the head and face. These attacks generally occur when a bear is accidentally stumbled upon by a native wandering in the jungle, and are then due more to timidity than to ferocity. Mr. Sanderson is of opinion that a bear, being a slow-witted animal, is more likely to attack in such a case than is a tiger or a leopard, which more rapidly collect their senses, and are thus less embarrassed by the sudden and unexpected encounter. Mr. Blanford states that when thus surprised a sloth-bear will sometimes merely knock a man over with its paws, although thereby inflicting severe wounds; but on other occasions it seizes and holds in its paws its unfortunate victim, who is not released until bitten and clawed to death. Females with young, and occasionally solitary bears, will at times make unprovoked attacks of great ferocity. The idea that sloth-bears hug their victims is scouted by both writers.

Sloth-bears are usually hunted in India either by driving them from cover with a line of beaters, or by the sportsman going to their caves or lairs among the rocks at daybreak, and shooting them as they return home from their nightly wanderings. Mr. Sanderson says that in the forests of Mysore he was in the habit of shooting bears by following them with trackers; and that, as they seldom left off feeding before nine in the morning, it was generally possible by starting at daybreak to come up with them before they had retired to rest for the day. If, however, the party did not succeed in this, the bears would generally be found lying asleep under the shade of a clump of bamboos, or a rock, as there were no caves in the district into which they could disappear. Elephants, it appears, have a great dislike to bears, and on this account, as well as from the rocky nature of the country generally inhabited by these animals, are but rarely employed in bear-shooting. Mr. Sanderson was also in the habit of hunting bears with large dogs, and despatching them when brought to bay with his hunting-knife; and in this exciting sport was very successful.

Regarding the sport afforded by the sloth-bear, the same hunter observes that

"bear-shooting is one of the most entertaining of sports. Some sportsmen have spoken disparagingly of it, and I daresay sitting up half the night watching for a bear's return to his cave, and killing him without adventure, may be poor fun . . . But bear-shooting conducted on proper principles, with two or three bears afoot together, lacks neither excitement nor amusement. It is not very dangerous sport, as the animal can be so easily seen, whilst he is not so active as a tiger or a panther. Still he is very tough, and to anyone who would value him for his demonstrations, he would appear sufficiently formidable. If a bear charges he can generally be killed without more ado by a shot in the head when within two paces. The belief that a bear rises on his hind-legs when near his adversary, and thus offers a shot at the horseshoe mark on his chest, is groundless. I have shot several bears within a few feet, and they were still coming on on all-fours. No doubt when a bear reaches his man he rises to claw and bite him, but not before."

Jerdon states that in the extreme south of India, among certain hill-tribes known as Polygars, sloth-bears used to be hunted with large dogs, and when brought to bay were attacked by the hunters with long poles smeared at the end with bird-lime. The bird-lime caused the shaggy coat of the bears to become fixed to the end of the pole, so that the animals soon became firmly held. A single fragment of a bone of the fore-limb discovered in a cave in Madras proves that the sloth-bear has been an inhabitant of India since a period when several kinds of extinct mammals flourished there. And the extinct Theobald's bear from the Siwalik Hills, mentioned on p. 26, serves to indicate that the sloth-bear is a specially-modified form derived from bears belonging to the typical genus, since the skull of that extinct species presents characters intermediate between those of ordinary bears and that of the sloth-bear.

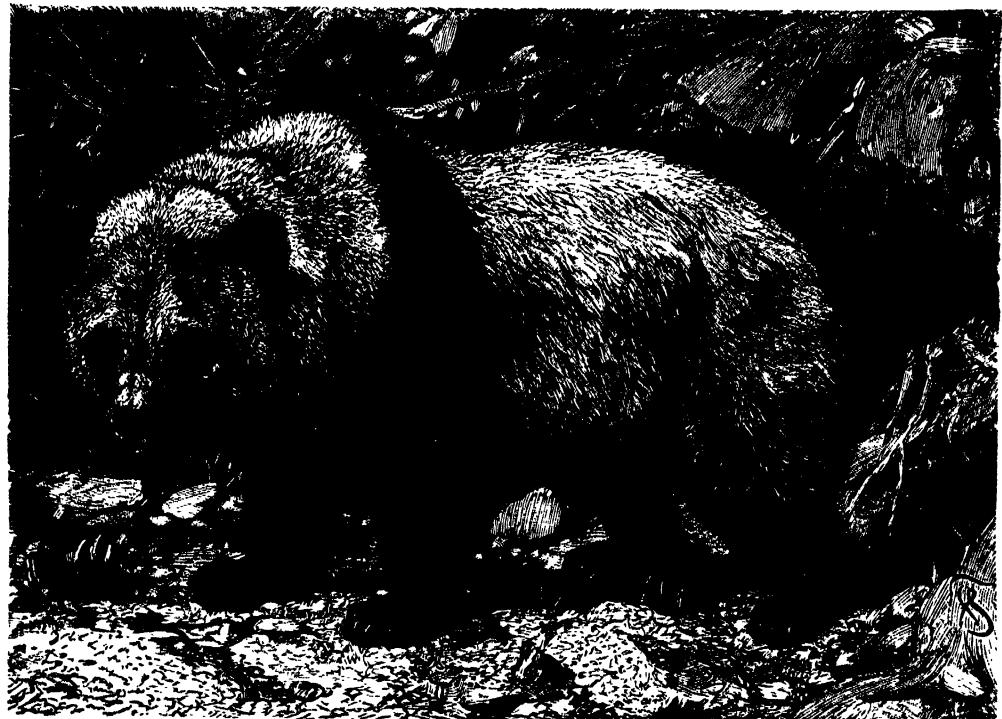
THE PARTI-COLOURED BEAR.

Genus *Æluropus*.

A large number of the mammals from the highlands of Tibet belong to types quite unlike those found in any other part of the world; and in no case is this dissimilarity more marked than in the animal which may be termed the parti-coloured bear (*Æluropus melanoleucus*).

This strange animal, which has been known to European science only since the year 1869, is of the approximate dimensions of a small brown bear, and has a general bear-like aspect, although differing from all the other members of the family in its parti-coloured coat. The fur is long and close, with a thick, woolly under-fur. The general colour is white, but the eyes are surrounded with black rings, the small ears are also black, while the shoulders are marked by a transverse stripe of the same colour gradually increasing in width as it approaches the fore-limbs, which are also entirely black, as are likewise the hind-limbs. This peculiar coloration communicates a most extraordinary appearance to the creature; and without knowing more of its natural surroundings it is difficult to imagine the object of such a staring contrast. The tail is extremely short; and the soles of the feet are hairy.

In addition to these external characteristics, the parti-coloured bear also presents some peculiar features in regard to the skull and teeth. Thus the skull is remarkable for the great width of the zygomatic arches and the enormous development of the longitudinal ridge on the upper-surface of the brain-case, both these features indicating greater power of jaw than has at present been found in any other member of the entire carnivorous order. Then, again, the teeth differ both in number and form from those of all the other Ursidae. Instead of the forty-two teeth, characteristic of the typical bears, the parti-coloured bear has but forty teeth, all told ; the diminution in number being due to the absence of the first pair of premolar



THE PARTI-COLOURED BEAR.

teeth in the lower jaw. As regards form, the molar teeth are distinguished from those of other bears by their shorter and wider crowns ; this being most marked in the first molar of the upper jaw, which is broader than it is long. The second upper molar tooth agrees, however, with the corresponding tooth of other bears in being longer than the one in front of it. The pattern formed by the tubercles on the crowns of these teeth is exceedingly complex, and approaches to that obtaining in the panda, among the raccoon family, to be noticed in the next chapter.

The parti-coloured bear is reported to inhabit the most inaccessible districts of Eastern Tibet, and to be of extremely rare occurrence. Unfortunately we are at present quite ignorant of its habits, although it is said to feed chiefly on roots and the young shoots of bamboos, and to be entirely herbivorous.

EXTINCT BEAR-LIKE GENERA.

At the close of the preceding volume it has been mentioned, that, unlike as modern dogs and bears are to each other, yet both families are merely divergent branches from a common stock. In that passage we referred only to those extinct animals most nearly related to the modern dogs, and it was then shown that the so-called amphicyon of the Miocene and upper part of the Eocene period appeared to be a dog with one more pair of upper molar teeth than the true dogs, and approaching the bears in its plantigrade feet. We have now to allude to the extinct genera more nearly allied to the modern bears. The first of these is a bear-like animal from the superficial deposits of South America, known as the arctotherium. This animal, of which the left side of

the palate is shown on a greatly-reduced scale in the accompanying figure, had the same number of teeth as the true bears. The upper molar teeth (the two on the right side of the figure) are, however, relatively shorter and wider than in the latter, and the second is not greatly larger than the first. Then, again, the upper flesh-tooth (the third from the right in the figure) is much larger than in modern



THE LEFT HALF OF THE UPPER JAW OF THE ARCTOTHERIUM—
AN EXTINCT SOUTH AMERICAN BEAR-LIKE ANIMAL
(much reduced).

bears, and is thus more like the corresponding teeth of other Carnivores. Further, the upper arm-bone, or humerus, has a perforation at its lower end, which is not found in any living dog or bear, although occurring in the extinct amphicyon.

Another type is the so-called hyænarcetus, of which large species occur in the Siwalik Hills of India and the Pliocene deposits of Europe, while smaller ones are

found in the European Miocene strata; the two upper molar teeth of one of the latter being shown in the accompanying woodcut. In these animals the upper molars (as in our illustration) were sometimes oblong, with the second not longer than the first; while, in other cases, they were more or less completely triangular, and thus but little different in form from the corresponding teeth of the dogs. The most important difference from the bears occurs, however, in the form of the flesh-tooth in both jaws; these teeth being

very similar to those of the dogs, and of a thoroughly carnivorous type. Whereas, however, the upper flesh-tooth of the dogs has but two lobes to its cutting blade, that of the hyænarcetus had three such lobes. That the hyænarcetus was a thoroughly carnivorous animal, there can be no reasonable doubt. Another Miocene Carnivore, known as the hemicyon, has still more dog-like teeth; and the transition from this animal to the plantigrade and dog-like amphicyon is, therefore, scarcely more than a step, so that the passage from the dog-like bears to the bear-like dogs is practically complete.



THE LEFT UPPER MOLAR
TEETH OF A SMALL
SPECIES OF HYÆN-
ARCTUS.—After Koken.

CHAPTER XVII.

CARNIVORES,—*continued.*

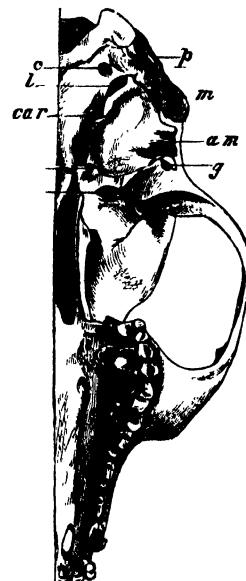
THE RACCOON FAMILY.

Family *PROCYONIDÆ*.

THE raccoons and their allies constitute a very small family of Carnivores, which, with the exception of one outlying and somewhat aberrant genus, are confined to America, and are very characteristic of the central and southern portions of that continent. Their nearest allies are the bears, with which they appear to be connected by the panda, of which the teeth present some resemblance to those of the parti-coloured bear. The skull has the same essential characteristics as in the bears, and the accompanying illustration of the right half of the skull in one of the raccoons is intended to show the position of the tympanic bulla, and its general form and relations in the present family and in the two allied families of the bears and the weasels.

The raccoons agree with the bears in their plantigrade feet (as is well exhibited in our figure of the panda), but differ in that they have only two, in place of three, molar teeth in the lower jaw. The upper molar teeth are, moreover (as shown in the accompanying figure), usually of the same general type as those of the dogs, having squared or triangular crowns, and being generally elongated in the transverse rather than in the antero-posterior direction; while the second of these teeth is smaller, instead of larger, than the first. Moreover, the flesh-tooth in each jaw approaches the ordinary carnivorous type, and is thus very different from the corresponding tooth of the modern bears; it has, however, three lobes to the blade, and a very large inner tubercular portion.

The members of the raccoon family are all animals of comparatively small size; and they differ markedly in general appearance from the bears in having well-developed tails, which may be of great length. Very generally the hair of the tail is marked by alternate dark and light rings. The whole of these animals are good climbers, and they are generally of more or less exclusively nocturnal habits.



THE RIGHT HALF OF THE
PALATAL ASPECT OF THE
SKULL OF THE CAC-

bulla, which is the swelling between that and the point indicated by *car*. The other letters indicate the various foramina, etc. (From *Proc. Zool. Soc.*—After Sir W. H. Flower.)

It is noteworthy that, with the exception of the one Old World genus, no remains of this family have ever been discovered beyond the limits of the New World.

THE PANDA.

Genus *Aelurus*.

The curious animal represented in the accompanying illustration, and known as the panda (*Aelurus fulgens*), is one in regard to whose serial position there has been much diversity of opinion. It was at one time placed in the bear family, next to the parti-coloured bear; while it has also been regarded as the representative of a distinct family by itself. Mr. Blanford has, however, come to the conclusion that its true position is in the raccoon family, and it is probable that this view will be pretty generally adopted in the future.

The panda, or, as it is often called, the red cat-bear, is restricted to the South-Eastern Himalaya, and may be compared in size to a large cat. Externally it is characterised by its broad and rounded head, in which the muzzle is extremely short, the small eyes are directed forwards, and the ears are of considerable size. The stout limbs are furnished with large, curved, and sharp claws, which can be partially retracted; and the soles of the large feet are covered with hair. The tail is long and rather thick, its length being nearly equal to that of the body, or rather more than two-thirds of that of the head and body together. The fur is long and thick, with a woolly under-fur.

In colour, a large portion of the fur of the panda is a bright, rusty red, of somewhat variable shade; this colour prevailing on the back, the upper part of the head, and the darker rings on the tail. The forehead is of a lighter tint of red, as are also the paler rings on the tail, its tip being black. The under-parts and the inner-surfaces of the limbs are black, tending to a brownish tint on the abdomen. The face, like the lower lips, is white, except for a vertical stripe of red proceeding from each eye to the angle of the mouth. Occasionally, however, as in the specimen here figured, there is also a red stripe running down the middle of the nose. The inner surface of the ears are also white, as are also the claws. A large male panda measured 24 inches from the tip of the snout to the root of the tail; while the length of the tail was 17 inches without the hair at the end, and 19½ inclusive of the hair. Other specimens measured respectively 20 and 22 inches to the root of the tail.

It is, however, not only externally that the panda is a remarkable creature. In its skull and teeth it is very unlike other Carnivores. Thus the skull is remarkably short, with the profile from the front teeth to the occiput forming a regular curve, which approximates to a semicircle. The lower jaw is also remarkable for its extremely convex and regularly-curved inferior border, and also for the great length of the portion which ascends on the sides of the skull. The total number of teeth in the panda is 38, of which, on each side of the jaws, $\frac{3}{4}$ are incisors, $\frac{1}{4}$ incisors, $\frac{3}{4}$ premolars, and $\frac{2}{3}$ molars. The canines, or tusks, are of no great size, but are remarkably flattened from side to side. The upper molars have very wide crowns, which are nearly square in outline, and carry

four main tubercles and an inner ridge; while the flesh-tooth in each jaw differs from that of all other members of the family in presenting but little approximation to the ordinary carnivorous type; being, indeed, more like that of the parti-coloured bear.

There appears to be some doubt as to the origin of the name panda, by which the animal is very generally known in this country, unless, indeed, it be a corruption of the Nipalese niyalaya-ponga; the latter name, according to Mr. Blanford, meaning bamboo-eater. It is also known in Nipal as the wah. The panda is unknown in the Himalaya to the westward of Nipal; but it there lives at elevations of from seven thousand to twelve thousand feet. Its eastward range



THE PANDA. (From *Proc. Zool. Soc.*—After Sclater.)

extends through the mountains to the north of Assam into the Chinese province of Yunnan.

An excellent account of the habits of the panda was published many years ago by Mr. Brian Hodgson, of which the following is a summary:—As we might have supposed from the structure of its teeth, the animal is mainly herbivorous. It is also an excellent climber, although feeding chiefly on the ground, and having its retreat and breeding-place in holes and clefts of the rocks. Its chief food is composed of various fruits, acorns, the young shoots of bamboos, roots, etc. It will, however, also eat eggs, but it is doubtful whether, as asserted, it will touch insects or their larvae, while recent observers are in accord as to its habitual rejection of all kinds of flesh. Hodgson states that it will sometimes steal down to the villages and feast on milk and butter. These animals feed in the morning and evening, and

sleep much during the day, although they are by no means exclusively nocturnal in their habits. On the ground, their movements are somewhat awkward and ungainly ; and they are generally sluggish and stupid in disposition, and allow themselves to be captured without much difficulty. They hiss and spit like cats when angered, and occasionally utter a low deep growl, somewhat like that of a young bear. According to Mr. Hodgson they drink by lapping with the tongue, but, from observations made on specimens in the Zoological Society's Gardens, this is denied by Mr. A. D. Bartlett, who states that they drink by putting their noses to the ground, after the fashion of a bear. They generally sleep curled up sideways, with the head concealed by the thick tail, but will also frequently repose by sitting down on their haunches with the head tucked in between the fore-paws, their habits being very similar to those of some of the raccoons.

In addition to the cries already mentioned, it appears from the account of an observer who watched a pair of these animals high up in the trees near Darjiling, that the panda will at certain times—probably the breeding-season—utter loud and somewhat unearthly cries, which may be heard at a considerable distance. They call one another by a kind of chirping cry. The panda is a quite harmless, and apparently an almost defenceless animal, its sharp and partially retractile claws being evidently adapted for the purpose of climbing, rather than as weapons of offence or defence.

The young, generally two in number, are born in a nest formed in some hollow tree or cavity among rocks. They are produced in the spring, and are helpless for a long period. It is stated that the cubs of one litter remain with the parent, till shortly before the birth of a second brood.

In captivity these animals are gentle and easily tamed, even when not captured until they have attained maturity. In this country they require great care and attention, from their extreme susceptibility to cold: but in the more congenial climate of Calcutta they thrive well in cages placed in the open air.

It is a remarkable circumstance that an extinct species of panda, about half as large again as the living form, once flourished in England. This is proved by the occurrence of teeth and fragments of jaws in the so-called Red Crag of the Suffolk coast, which belongs to the Pliocene period. It is, therefore, probable that the genus was once widely spread over the Old World; while its occurrence in England proves that the country must have been formerly thickly covered with forest, and have enjoyed a climate of a subtropical nature.

THE RACCOONS.

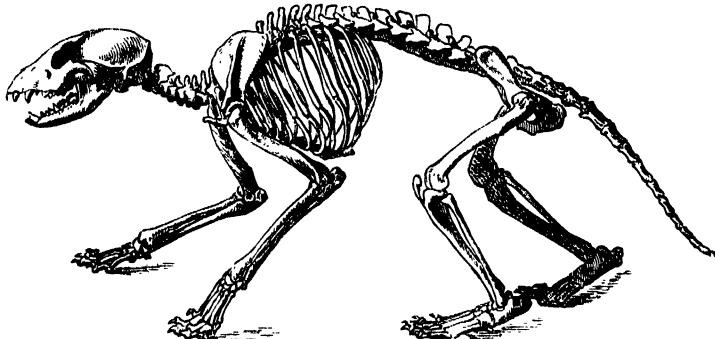
Genus *Procyon*.

The widely-known raccoons, of which there are two or three species, are the typical representatives of the family, and, like all the remaining forms, they are exclusively American. These animals have a total of forty teeth, or two more than in the panda, owing to the presence of the whole of the four typical pairs of premolars in the lower jaw. The cheek-teeth differ from those of the latter in

being more like the ordinary carnivorous type; while the skull has not the short and convex form of the panda's.

Externally, the raccoons are characterised by their thickly-built and stout bodies, their heads broad behind but tapering to a sharp point at the muzzle, and their medium-sized and distinctly-ringed tails. The ears are small and rounded. When walking, the entire sole of the foot is not applied to the ground, as it is when the animal is standing at rest; while the toes themselves, and more especially those of the fore-feet, can be spread out very widely. The compressed and curved nails differ from those of the panda in being entirely non-retractile. The fur is characterised by its length, softness, and thickness, and is greatly developed on the tail, but is very short on the feet, of which the soles are naked.

The best-known species is the common raccoon (*Procyon lotor*), of which a group is represented on the next page. The total length of this animal varies from about 32 to 36 inches, of which some 10 inches are occupied by the tail. The body is covered with thick and rather coarse fur, of a dark brown colour, with the



SKELETON OF RACCOON.

tips of the hairs greyish; but there is a distinct black patch on either side of the face, including the eyes, and the muzzle is naked. The tail has five black rings, separated by others of a whitish colour, and its tip is black. When in its best condition, which is usually in the autumn, a raccoon will weigh from 15 to 25 lbs. There is considerable local variation in the colour of this species; the coloration being most brilliant in the southern portion of its range, where its bodily size is also greater than in the north. The common raccoon is confined to Northern and Central America, extending from Alaska in the north to Costa Rica in the south, and occurring over the whole of the United States, where these animals used to be among the commonest.

The best of the recent accounts of this raccoon is given by Dr.

Habits. Hart Merriam, who tells us that raccoons are exceedingly common about the borders of the Adirondacks, but avoid the dense evergreen forests of the interior. Although, with the exception of bats and flying squirrels, they are the most strictly nocturnal of all North American Mammals, yet they may occasionally be seen abroad on cloudy days. In diet they are thoroughly carnivorous—feeding upon mice, young birds, birds' eggs, fresh-water tortoises and

their eggs, frogs, fish, cray-fish, molluscs, insects, nuts and fruits and corn; while they will sometimes kill and eat domestic poultry. They delight to sport in the shallow water on the margins of pools and streams, where they capture the cray-fish lurking beneath the stones, and the fresh-water mussels buried in the mud and sand. They also catch such fish as happen to get stranded or detained in the small pools near the shore, although they are unable to dive in pursuit of their



THE COMMON RACCOON ($\frac{1}{2}$ nat. size).

prey. They are, however, good swimmers. Although first-rate climbers, and making their nests in a hollow high up in some large tree, raccoons cannot be considered by any means thoroughly arboreal animals. Thus they neither hunt their prey among the tree-tops, nor gather nuts and fruits from the branches, nor do they feed upon the young shoots and twigs. Trees form, however, their resting and their breeding-places, and likewise their refuge when pursued by human or other foes. With the falling shades of night they invariably descend to hunt their prey and search for food.

Continuing our account in Dr. Merriam's own words, we find that in the Adirondack region "the raccoon hibernates during the severest part of the winter, retiring to his nest rather early, and appearing again in February or March, according to the earliness or lateness of the season. Disliking to wade through deep snow he does not come out much till the alternate thawing and freezing of the surface, suggestive of coming spring, makes a hard crust upon which he can run with ease. He does not usually walk many miles during a single night, and consequently is soon tracked to the tree, in some hole of which he has retired for the day. It is unusual to find a raccoon alone, for they commonly live and travel in small companies, consisting of the several members of a single family. They do not return to the same nest every morning, but often make little excursions in various directions, being gone several days at a time, and taking refuge, about daylight, in any convenient arboreal shelter. Though preferring a hollow limb high up in some giant elm, ash, or basswood, they will put up with almost any kind of a hollow trunk. I have known them to spend the day in old stubs, in hollow logs, and even in the poor shelter afforded by the angle where a falling tree had lodged in a crutch." Probably, in Central America and the more southern districts of North America, this raccoon remains active throughout the winter, as the climate would not necessitate any hibernation. In the Adirondacks the young are produced in the spring—generally during the month of April; and there are usually from four to six in a litter. They remain with their parent about a twelvemonth. The nest which, as already mentioned, is placed high up in a tree, has but little care bestowed upon its construction.

It has long been known that this raccoon is in the habit of moistening its food with water before eating it; and it doubtless received its distinctive specific name from this habit, which has been of late years verified by Mr. Bartlett's observations on specimens in the Zoological Society's Gardens. The raccoon is one of the most valuable of the fur-bearing animals of North America, and is consequently much persecuted. Raccoon skins were formerly used as a recognised circulating medium in the States of the Mississippi Valley, and were usually valued at 25 cents apiece.

According to Mr. D. Arrowsmith, the raccoon may be easily caught in steel traps; but it is essential that these should be set under water near the margins of swamps or streams. The more sporting method is, however, to hunt these animals at night with specially-trained dogs, which are usually a breed of fox-hounds. It has often been stated that the raccoon leaves a very faint foot-scent; but this opinion is controverted by Mr. Arrowsmith, who states that he has known a hound hunt a raccoon at midday over snow, on a trail which had been made the previous night. The raccoons, after a short run, invariably take to the tree, where they are shot by the hunter, unless they conceal themselves in a hole.

Crab-Eating Raccoon. The crab-eating raccoon (*P. cancrivorus*) is a nearly-allied South American species, distinguished by its superior dimensions and its much shorter fur, as well as by its proportionately larger teeth. It is found typically from Panama to Colombia and Guiana; but Professor Mivart is of opinion that the raccoons found further to the south, and extending through Brazil to Paraguay, are entitled to rank as a distinct species, on account of their darker

feet. The name of black-footed raccoon has, accordingly, been proposed for this southern form. These raccoons are very common in certain districts, and appear to agree closely in habits with their northern cousin.

THE CACOMISTLES.

Genus *Bassaris*.

The cacomistles, of which the skull is shown on p. 35, are animals nearly allied to the raccoons, but of more slender build, with a sharper muzzle, longer tail, less perfectly plantigrade feet, and teeth of a more typically carnivorous type.

The common cacomistle (*Bassaris astuta*), represented in the accompanying illustration, is an inhabitant of the United States and Mexico. It is covered with



THE CACOMISTLE (1/2 nat. size).

long and soft fur; and has also well-developed and pointed ears, of which the outer surfaces are nearly naked. The feet have naked pads, but are otherwise hairy; and their short claws are partially retractile. In size this animal may be compared to a cat, the length of the head and body being about $17\frac{1}{2}$ inches, and that of the tail (including the hair at the end) nearly the same. The general colour is brownish-yellow mixed with grey on the upper-parts, and whitish below; but the tips of the ears, and two pieces of spots above and below the eyes, are yellowish-white. The bushy tail, which differs from that of the raccoons in being depressed instead of cylindrical, has a black tip and seven or eight blackish-brown rings, separated by white intervals.

This animal dwells among rocks and trees; and although, on account of its purely nocturnal habits, but seldom seen, is far from uncommon in certain localities. Like the raccoons it is easily tamed, and makes a pretty pet, being sometimes kept for the purpose of killing rats and mice. It is, however, for its size, a bold and ferocious animal, and is reported to be very destructive to poultry. Cacomistles prefer woods well supplied with water, and make their nests in

the holes of trees. The natives are in the habit of finding out whether such a hole is tenanted by a cacomistle, by noting if the bark surrounding the aperture has been removed; this removal of the bark being an invariable custom of the animal. From three to four young are produced at a birth. *B. astuta* is in the habit of carrying its tail bent back over its back. The only other species is Sumichrast's cacomistle (*B. sumichrasti*) from Central America.

Another raccoon-like type of animal has been named *Bassaricyon*, and is at present known to science only by a single skull from Costa Rica, and a skin from Ecuador. These animals, which are probably extremely rare, have the same number of teeth as the raccoons, but approximate so closely in appearance to the under-mentioned kinkajou, that they are probably often mistaken for it by collectors. Mr. O. Thomas considers that the resemblance of the two animals is a case of true mimicry, although he is unable to imagine of what advantage it can be for the bassaricyon to be mistaken for a kinkajou.

THE COATIS.

Genus *Nasua*.

The coatis, or, as they are often called, coatinundis, are easily recognised by the great length of their snouts, on which account they are called by the Germans *Rüsselbären* (proboscis-bears). They have the same number of teeth as the raccoons, but the tusks, or canines, are longer and more flattened; while, in conformity with the length of the snout, the skull is relatively longer and narrower.

The snout, which is naked at the tip, is somewhat upturned, and projects far beyond the extremity of the lower jaw, as is well shown in our coloured Plate; it is capable of a considerable amount of motion. The body is long, and rather flattened, and the tapering tail is also elongated and of considerable depth. The toes are more closely connected together than the raccoons, and are provided with longer and stouter claws. There are two species of coatis. One of these, the white-nosed coati (*Nasua nasica*), which is the species represented in the coloured Plate, inhabits Mexico and Central America. It is characterised by the white nose and upper lip, the dark brown face and cheeks, and the length and softness of its fur. In colour the long hairs of the back are tipped with either rufous, fulvous, or whitish; and the tail is frequently of the same colour as the back, though it may have dark and light rings on the under-side of the basal half, or, as in our illustration, complete rings.

The second species is the red coat: (*N. rufa*), inhabiting South America from Surinam to Paraguay. In this species the fur is generally short and harsh, with the longer hairs on the back tipped with black. The ears are relatively larger and more hairy; and the tail is invariably marked with from seven to nine broad fulvous or rufous rings alternating with black ones; its tip being black. Both species are subject, however, to considerable individual variations of colour, and the distinction between them is sometimes difficult to make out.

Habits. These animals usually go about in small troops, comprising from about eight to twenty individuals; and are mainly arboreal. Their

food includes fruits, young birds, eggs, lizards, and insects. In Costa Rica they are found in the mountains at elevations of from six thousand to seven thousand feet. In Nicaragua Mr. Belt observed them hunting the large lizards known as iguanas. When, however, an iguana was surprised by a coati, it immediately fell from the bough on which it was reposing to the ground, and thence escaped to another. Nothing daunted, the coati would renew the pursuit again and again. Frequently the coatimundis would divide their troop into two sections, one of which made its way through the branches above, while the other hunted on the ground below, so that any prey which might fall from the trees had but a poor chance of escape. In Guatemala coatimundis are among the most common of all mammals, and may be found at all elevations in the mountain-forests, from the level of the sea up to nine thousand feet. They are very readily tamed, and are often kept by the Spaniards in South America chained to one of the pillars of the corridor surrounding the courtyards of their houses.

That coatimundis are aboriginal inhabitants of South America is proved by the occurrence of their fossilised remains side by side with those of many extinct mammals in the caverns of Lagoa Santa, in Brazil. They are also represented in deposits of still earlier age in Argentina, where the species have been referred to a distinct genus (*Cynonasua*).

THE KINKAJOU.

Genus *Cercoleptes*.

THE last representative of the Raccoon family is the kinkajou, or jupura (*C. caudivolvulus*), which is the most arboreal form of all, and is distinguished by its prehensile tail—a character possessed by it in common with the Indian binturong. The kinkajou is distinguished from the other American members of the family by having but thirty-six teeth, owing to the disappearance of a pair of premolars in each jaw. It is a long and rather low-bodied animal, with a rounded and broad head, in which the muzzle is short, and the front of the nose marked by a median vertical groove. The ears are small and rounded. The limbs are short, with naked soles to the feet, and long, powerful, and much curved claws. The tail, which, as we have said, is prehensile, is cylindrical, of moderate thickness, and of great relative length, being fully as long as the head and body together. The animal is further distinguished by the great length of its tongue, which can be protruded a considerable distance in front of the mouth. The fur is soft, short, and of an almost woolly nature, with nearly the same length over the whole body and tail, and is of a pale yellowish-brown colour throughout. In size the kinkajou may be compared to a cat. It is found in wooded districts from Central Mexico to the Rio Negro in Brazil. In Guatemala, where it is far from rare, it ranges to elevations of four thousand and five thousand feet above the sea. It conceals itself in the holes of trees,—in which it probably also breeds,—issuing forth only at night in search of food. A specimen which fell, when wounded, from a tree into a river below swam well. It feeds on small mammals, birds and their eggs, honey and fruits, and appears to be specially partial to oranges and bananas.

The expression of the kinkajou reminded Bates strongly of that of some of the



WHITE-NOSED COATI.

lemurs; and he was also struck with the extreme brightness of its dark eyes. "I once saw it," he writes, "in considerable numbers when on an excursion with an Indian companion along the low Ygapo shores of the Teffé, about twenty miles above Ega [on the upper Amazon]. We slept one night at the house of a native family living in the thick of the forest, where a festival was going on, and there being no room to hang our hammocks under shelter, on account of the number of visitors, we lay down on a mat in the open air, near a shed which stood in the midst of a grove of forest trees and pupunha palms. Past midnight, when all became still after the uproar of the holiday-making, as I was listening to the dull, fanning sound made by the wings of impish hosts of vampire-bats crowding



THE KINKAJOU ($\frac{1}{2}$ nat. size).

round the cajer trees, a rustle commenced from the side of the woods, and a troop of slender, long-tailed animals were seen against the clear moonlit sky, taking flying leaps from branch to branch through the grove. Many of them stopped at the pupunha trees, and the hustling, twittering, and screaming, with the sounds of falling fruits, showed how they were employed. I thought at first they were *Nyctipithei*, but they proved to be jupuras, for the owner of the house early next morning caught a young one, and gave it to me. I kept this as a pet animal for several weeks, feeding it on bananas and mandioca-meal mixed with treacle. It became tame in a very short time, allowing itself to be caressed, but making a distinction in the degree of confidence it showed between myself and strangers. My pet was unfortunately killed by a neighbour's dog, which entered the room where it was kept."

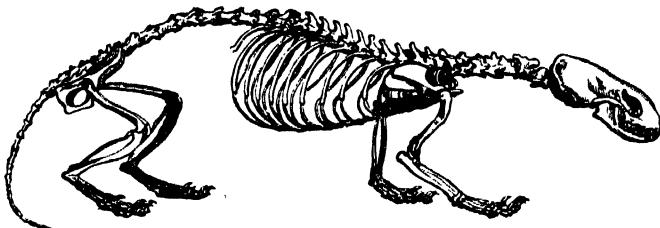
CHAPTER XVIII.

CARNIVORES,—*continued.*

THE WEASEL FAMILY.

Family *MUSTELIDÆ*.

WITH the Weasel family, in which are included not only the weasels and their immediate allies, but likewise the badgers and otters, we come to the last group of terrestrial Carnivores. The family is thus a very extensive one, and also one in which many of the various members differ very widely from one another in external appearances, as well as in the structure of their teeth. A large number of the species—and among them the typical forms—are, however, characterised by



SKELETON OF WEASEL.

their long and slender bodies and short limbs; while the great majority are of medium or small size, and none are very large.

In the general characters of the base of the skull the members of the Weasel family agree with the Bears and Raccoons. They are, however, distinguished from these by having but a single pair of molar teeth in the upper jaw, while they agree with the raccoons in generally having but two pairs of these teeth in the lower jaw. The ratels have, however, only a single pair of lower molar teeth. The skull of any member of the family may always be distinguished from that of any other Carnivore by the inner portion of the upper molar tooth being wider in the antero-posterior direction than its outer portion, this character being exhibited in the figure of the palate of an otter given later on, although in this case the whole tooth is relatively wider than usual. The skull is further characterised by the great development of the curved ridges of bone by which the lower jaw is held in place, which grip the condyle of the latter so tightly that it is sometimes difficult or impossible to detach it from the skull proper. As in the two preceding families, the feet are in all cases provided with five toes.

From the structure of the skull, as well as from certain features in the

anatomy of the soft parts, it has been generally considered that the weasels are most nearly allied to the bears and raccoons; and, as a matter of convenience, it is found best to continue to place them in this position, as it somewhat simplifies classification. The evidence furnished by the numerous forms of extinct Carnivores, which have been discovered of late years in the middle and lower Tertiary rocks of Europe and North America, points, however, very strongly to the conclusion that the nearest allies of the weasels are in reality the civets, and that the former group is the direct descendant of the latter. If this view be true,—and the evidence in its favour is very strong indeed,—it follows that the structural resemblance of the weasels to the bears and raccoons is an instance of what is termed parallel development, and indicates no near genetic connection between the two groups.

The family is a very widely distributed one, having representatives on all the great continents, with the exception of Australia. It attains, however, its maximum development in the temperate regions of the Northern Hemisphere; and it may be noted that none of its members inhabit Madagascar. In regard to coloration there is an enormous amount of variation. Several of the northern forms have a dark summer and a light winter dress, and thereby differ from all other Carnivores except the Arctic fox. Then a large number of the martens and weasels and all the otters are clothed with fur of a nearly uniform dark tint, while one of the martens and some of the badgers are remarkable for their extreme brilliance. Moreover, the American skunks and the Cape polecat (*Ictonyx*) are remarkable for their contrasting bands of black or dark brown and white, and thus form some of the most conspicuously-coloured of all mammals. It is also noteworthy that in the parti-coloured examples there is a great tendency for the under-parts of the body to be darker than the upper; whereas, it is scarcely necessary to observe, the reverse is the case in the great majority of mammals. Again, there is a tendency for the different colours to arrange themselves in longitudinal lines or patches, or so as to make the whole of the upper-surface of the body light, and its under-surface dark; and in no case are there either spots or transverse bands of colour, while equally noteworthy is the entire absence of alternating dark and light rings of colour on the tail. Many of the members of this family yield furs of great commercial value.

The various members of the family are generally divided into three main groups, distinguished from one another by the characters of their teeth and claws. These groups are the weasels, the badgers, and the otters, which we proceed to consider in the order named.

THE TAYRA AND GRISON.

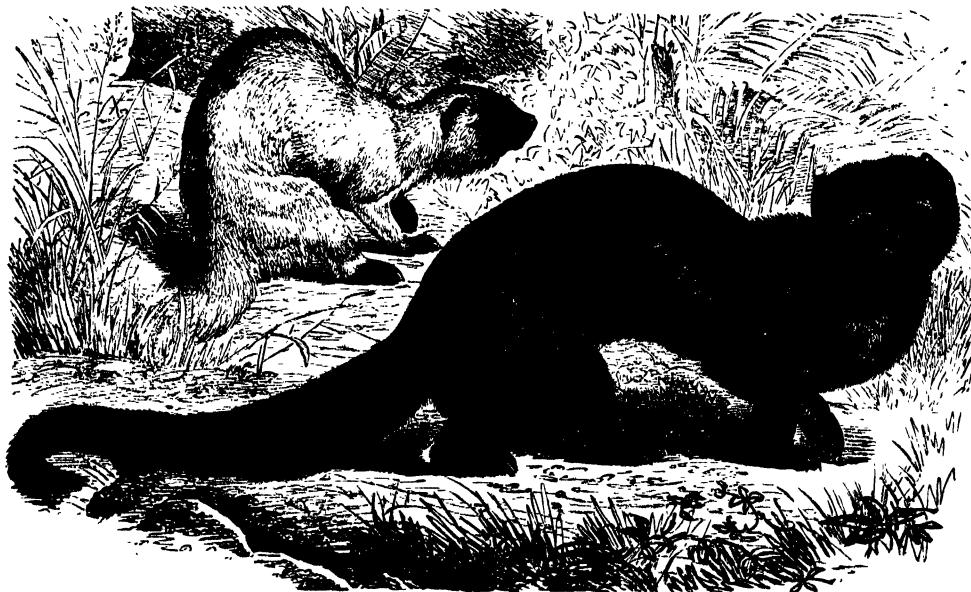
Genus *Galictis*.

The first representatives of the weasel group are the peculiar South and Tropical American species, which are respectively known as the tayra and the grison. The principal distinctive features of the group to which these belong are briefly as follows.

In the whole group the toes are short and only partially webbed, with short,

sharp, and curved claws, which may be partially retractile. The single upper molar tooth on each side is characterised by its narrowness from front to back, and its moderate dimensions. With the exception of the wolverene, all the members of the group are distinguished by their long and weasel-like bodies and short legs, while all are terrestrial and arboreal in their habits. Exclusive of the members of the present genus and one South-African species, the group is mainly confined to the northern parts of Europe, Asia, and North America, only a single representative occurring in Peninsular India, Burma, and the Malayan region, and one in South America.

The tayra and grison are characterised by having a total of 34 teeth, of which $\frac{2}{3}$ are incisors, $\frac{1}{3}$ canines, $\frac{2}{3}$ premolars, and $\frac{1}{2}$ molars. Their skulls may be readily



THE TAYRA (♂ nat. size).

distinguished from those of the martens and weasels by the tubercle on the inner side of the upper flesh-tooth being placed near the middle of the tooth, instead of close up to its front edge. They walk to a great extent on the soles of their feet, which are completely naked, so that their feet are almost, but not quite, plantigrade. The claws cannot be retracted. The head is characterised by its breadth and flatness, and is furnished with very small and rounded ears. The tail varies in length from about one-half to three-quarters the length of the head and body.

Tayra. The tayra (*Galictis barbara*) is the largest species, and may be

compared in size to the common otter, its total length being a little over a yard, of which rather less than half is occupied by the tail. The body and limbs are usually of a uniform dark brown colour, becoming almost black in some individuals, while in others it is lighter. There is always a lighter spot on the chest. The head and neck are generally grey, but in two immature individuals in

the British Museum they are nearly white, with the exception of the muzzle, which is dark. Occasionally, individuals are met with in which the whole of the fur, except that on the muzzle, ears, and feet, is entirely white; one such example being shown in the upper figure of our illustration. The nose has a vertical groove at its extremity, the teeth are relatively large and protruding, and the aspect of the animal is ugly and forbidding.

The range of the tayra is generally stated to extend from Mexico in the north to the Rio de la Plata in the south, but it also includes some of the more southerly portions of the Argentine pampas. In British Honduras tayras were observed by Moore hunting in companies of from fifteen to twenty, and although some writers have doubted the correctness of this statement, it is fully confirmed by Mr. Hudson in Argentina. Rengger states that the tayra lives both in open grass-clad country, and likewise in forest. Writing of this and the next species, Mr. Hudson says that, on the pampas of Argentina, "there are two quaint-looking weasels, intensely black in colour, and grey on the back and flat crown. One is a large bold animal (*G. barbara*) that hunts in companies; and when these long-bodied creatures sit up erect, glaring with beady eyes, grinning and chattering at the passer-by, they look like little friars in black robes and grey cowl; but the expression on their round faces is malignant and bloodthirsty beyond anything in nature, and it would, perhaps, be more decent to liken them to devils rather than to humans."

Although largely nocturnal in its habits, the tayra will frequently hunt till midday, when it seeks its lair and reposes till evening. This lair is generally either the deserted burrow of an armadillo, or some hole in a tree. The food of the animal consists of such mammals as it is able to kill, such as agutis and other rodents, but it also eats birds and their eggs. In inhabited districts the tayra frequently raids on poultry-houses, among the inmates of which it commits much havoc. Honey it also readily eats. The nest, which is sometimes made in the cavities of rocks, instead of in a hollow tree or deserted burrow, is constructed with much care. In one nest, examined by Hensel, two young were found, which were then quite blind, and had much the appearance of young foxes.

Grison. This (*G. vittata*) is a smaller animal than the tayra, and may be compared in size to a marten or an Indian mongoose. It is also readily distinguished by its relatively shorter tail, of which the length does not exceed half that of the head and body, and likewise by its coloration. The latter is of that peculiar type to which we have already referred, in which the under-parts are much darker than the upper. The snout, the under-surface of the neck, and the under-parts of the body are very dark brown, whereas the whole of the upper-surface, from the forehead nearly to the tip of the tail, is of a uniform bluish-grey tint, the individual hairs being ringed with black and white. From the forehead to the shoulder the grey and brown areas are divided by a lighter band with a yellowish tinge, while the tip of the tail and the ears are distinctly yellow. There is no groove on the nose. The grison is found over the greater part of South America, as well as in Central America and Mexico; and there is also Allemand's grison (*G. allemandi*), which is of larger size, but has the same general coloration, although presenting some approximation to the tayra.

The general habits of the grison appear to be very similar to those of the tayra. It is described as being the Carnivore most commonly encountered on the coasts of South America; but in Brazil it is stated to be less frequent than its cousin. By preference it appears to select the open country, although it may also be found in forests. It frequents plantations, and commits great depredations upon domestic poultry. Hollow trees, clefts in rocks, and deserted burrows, are its favourite retreats; but it is said that, when hunted with dogs, the grison will never attempt to climb, and invariably takes shelter under rocks, or beneath the roots of trees. Fossil remains of various species of this genus have been found in the caverns of Lagoa Santa, in Brazil; while, what is more noteworthy, others have been obtained from the superficial deposits of the United States, thus indicating that the genus formerly extended far to the northwards of its present limits in Mexico.

THE MARTENS, POLECATS, AND WEASELS.

Genus *Mustela*.

The martens and their near allies the polecats, stoats, and weasels, constitute the typical group of this subdivision. By many writers the large martens are separated as a genus from the smaller polecats, stoats, and weasels, the three latter being grouped together under the title of *Putorius*, but in this we are not disposed to concur. It is true that the martens have one more pair of premolar teeth in each jaw than their smaller relatives; but we cannot in any case attach much importance to such a difference, and its triviality is proved by extinct species, which exhibit a considerable amount of diversity in this respect.

Regarding, then, all the animals above mentioned as constituting but a single genus, we have to indicate the features by which the group is distinguished.

In the first place, the number of teeth may either be the same as in the tayra, or there may be an additional premolar tooth on each side of both the upper and the lower jaw, thus raising the number of teeth to forty. The upper flesh-tooth, as already mentioned, differs from that of the tayra by having the lobe on its inner side placed close up to its front edge. With regard to external characters, the martens and weasels are distinguished from the members of the preceding genus by their habit of walking almost entirely on their toes (digitigrade), and also by their short and compressed claws being capable of partial retraction. Their tails are either long or of medium length, and more or less bushy. It may be added that the lower flesh-tooth of the martens and weasels is characterised by the small size or total absence of the cusp on the inner side of the second lobe of the blade; and as the heel at the hinder end is also rather small and furnished with a cutting edge, the whole tooth consists of three main cusps, of which the two end ones are similar. Such a tooth is, therefore, totally unlike the lower flesh-tooth of a civet.

Pine-Marten. The well-known European pine-marten, or yellow-breasted marten (*M. martes*), may be regarded as the typical representative of the martens, all of which possess the following features in common. First of all, they have four pairs of premolar teeth in each jaw; while the flesh-tooth of the lower

jaw has a distinct cusp on the inner side of the second lobe of the blade. Moreover, they are of comparatively large size, and may be compared in this respect to the domestic cat. In all of them the body is much elongated, although to a less degree than is the case with the polecats and weasels. The martens are found only in the Northern Hemisphere, and range far to the northwards; one species, however, occurring as far south as India and the Malayan region.

The pine-marten has a total length of from 25 to 30 inches, of which from 16 to 18 inches are occupied by the head and body, and from 9 to 12 inches by the tail, inclusive of the hair at its extremity. As in the other members of this group, the muzzle is sharply pointed, with the nose extending a little beyond the lips;



THE PINE-MARTEN ($\frac{1}{2}$ nat. size).

and the ears are thickly covered with hairs on both sides. Beneath the glossy outer fur there is a thick coat of under-fur; and the soles of the feet have a thick coat of fur between the bare pads.

The pine-marten is characterised by the rich brown colour of the fur, and the reddish grey tint and yellow tips of the under-fur; the light-coloured fur on the throat and chest varying in tint from yellowish white to a bright orange. The range of this species includes a large portion of Northern Europe and Asia; and in former years the animal was common in the British Isles, where it is now restricted to the wilder districts. From the specific designation of this marten, it would naturally be supposed that it exhibits an especial predilection for pine-forests. This, however, does not appear to be the case, and it would seem that the name was given merely from the circumstance that pine forests are abundant in many of the districts which it inhabits.

Habits. Like the other members of the group, it is chiefly arboreal in its habits, and thereby differs markedly from the weasels, which are more terrestrial. "Creeping from branch to branch in silent and stealthy pursuit of birds, squirrels, and other small animals," writes Bell, "their sharp and long claws afford them a firm and secure hold of the bark, whilst the long and somewhat bushy tail must considerably aid them in maintaining their balance on the boughs; the ears, too, are large and open, a circumstance which is of great advantage to them in discovering and pursuing their prey, amidst the dense foliage in which they love to conceal themselves." Martens will, however, frequently descend to the ground, when they will destroy mice, rats, and moles, as well as rabbits and hares, and, it is said, even lambs. They are also deadly enemies to domestic poultry of all kinds; while in the neighbourhood of the sea-coast they are also reported to feed on mussels. When domesticated, it is said on good authority that they will eat fruit.

Although it was long considered that the beech-marten was also found in the British Islands, it is now ascertained that the present species is the only member of the group that has ever occurred here. Regarding its present distribution here, the late Mr. Alston, to whom we are indebted for the clearing up of this confusion, writing in 1879, states that in the wilder districts of Scotland, as well as in the north of England, Wales, and Ireland, the marten still holds its own; while specimens are occasionally captured in districts where it is now practically extinct. Thus one was shot in Norfolk in the year 1878, while another was killed in Hertfordshire in 1872. In Ireland the animal was, when Mr. Alston wrote, occasionally seen even in County Dublin.

Beech-Marten. The beech or white-breasted marten (*M. foina*), formerly supposed to be an inhabitant of the British Islands, is generally of a greyish brown colour, although the tint may vary from a whitish brown to deep blackish brown, with the tail and limbs generally darker than the body. The light area on the throat and chest, which may vary considerably in extent in different individuals, is invariably white; while the colour of the under-fur varies from ashy to pure white. The skull is also proportionately wider than in the last species, and there are also certain characters in the teeth by means of which the one species can be distinguished from the other. The length of the head and body is about 18 inches, and that of the tail, with the hair at the end, 13 inches.

Distribution. This species is a more southern form than the last, being widely distributed in Europe, but not reaching either the British Islands or Scandinavia; while to the eastward it extends into Asia as far as Turkestan and the Eastern Himalaya. In the latter districts examples have been procured from Afghanistan in the west to Sikkim in the east, and also from Kumaun and Ladak; further eastwards it appears to be unknown. Throughout the Himalaya it is generally found at considerable elevations, although descending as low as five thousand feet in the Gilgit district. It inhabits the whole of Central Europe and Italy, the warmer parts of European Russia as far as the Urals, as well as the Crimea; the western and northern slopes of the Caucasus, Palestine, Syria, and Asia Minor. It appears, however, to be unknown in Persia.

Habits. Over the greater part of Europe this marten is a commoner animal than the preceding, which it also exceeds in the greater boldness of its disposition. Although it is a frequenter of woods and trees, it is also found not uncommonly among rocks and stones, and hence receives its German name of *steinmarder*. In barren districts like Ladak this marten must, of course, nearly always dwell among rocks. From its bold disposition it is frequently found in the neighbourhood of human habitations, where it inflicts much damage on poultry.

In its general mode of life the species closely resembles *M. martes*. The nest is carefully formed of hay and straw, and situated in a hole in a tree, in the crannies between rocks, or in an old barn or granary. The young, generally from four to five in number, are born about the month of April, and are blind for the first fortnight of their existence. Its wanderings at night during the summer are



THE BEECH-MARTEN ($\frac{1}{2}$ nat. size).

extensive; and no dove-cot--however lofty it may be—is safe when there is a marten anywhere in the neighbourhood. The food of this species is much the same as that of the last, although in inhabited districts including more domesticated animals. It feeds on mice, rats, rabbits, and all kinds of birds; and, when dwelling in woods, hunts and kills squirrels, lizards, and frogs. It likewise eats fruits of various kinds, such as cherries and plums; and in some parts of the Continent is considered to do so much harm to orchards that the stems of the trees are washed with tobacco-juice or petroleum in order to prevent the marten from ascending them. Like all its kindred, the beech-marten is, for its size, an exceedingly bloodthirsty creature, and will often kill more than it can devour.

Although generally silent, in the pairing-season, which takes place towards the end of February (or about three weeks later than that of the pine-marten), these animals utter a kind of mewing sound not unlike that of a cat; and a pair of them in a tree may be heard for a considerable distance.

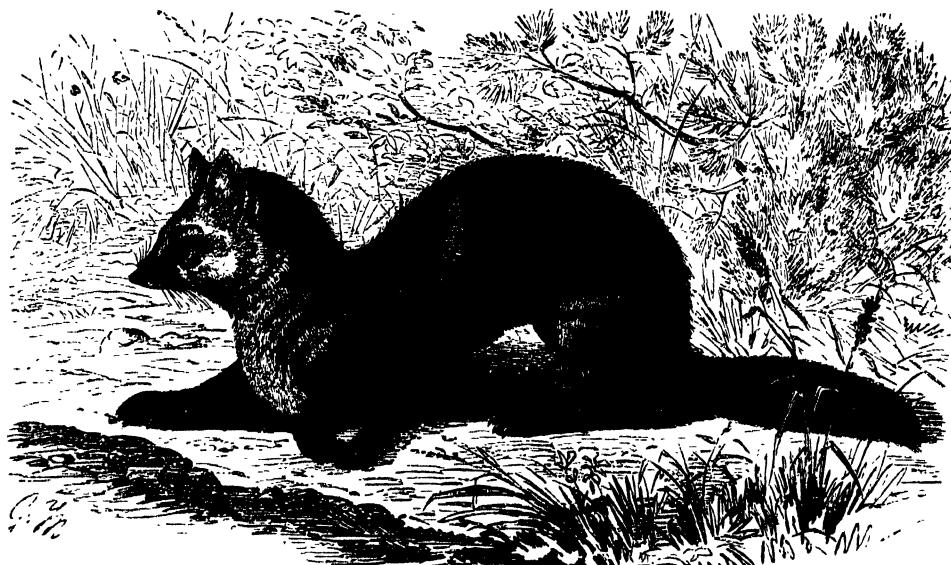
In general the fur of this species is less valued than that of the pine-marten; but some skins from Afghanistan and Turkestan have beautiful fur, with long, glossy, nearly black piles, and very soft white or pale ashy under-fur. These Turkestan martens were at one time regarded as belonging to a distinct species. The inferiority of the fur of the ordinary beech-marten, as compared with that of the sable, is due not only to its colour and actual length, but likewise to the relative length of the long piles as compared with that of the under-fur, which is scarcely concealed by them. The more northern skins are always superior to those from Southern Europe; and a large number are imported into this country and sold as an inferior kind of sable. As already mentioned, it was considered by the late Professor Rolleston that the domesticated animal employed by the ancient Greeks for the purposes for which we now use the cat, and called by them the *Ailouros*, was this marten, which is often spoken of as the white-breasted marten. Fossil remains of martens occur in the cavern deposits of the Continent; but only those of the pine-marten have as yet been found in England.

Sable. The sable (*M. zibellina*) is so nearly allied to the pine-marten that some writers have considered that it should be regarded merely as a variety distinguished by the greater length and fineness of the fur. Brehm states, however, that it has a much more distinctly cone-shaped head, larger ears, longer and stouter limbs, and proportionately larger feet. In the most highly-esteemed specimens the fur should be thick, soft, and nearly uniformly coloured. Such skins are blackish above, having a mixture of black and grey on the snout, grey on the cheeks, chestnut-brown on the neck and flanks, and orange-yellow, or sometimes reddish orange on the throat. The margins of the ears are either greyish white or light brown in colour. In a number of cases there is a larger or smaller admixture of white hairs among the dark fur of the back, while the muzzle, cheeks, breast, and under-parts are white. In other specimens the fur on the back is yellowish brown, while that of the under-parts is nearly white, and only the legs black. Good skins should exhibit a kind of "watering," owing to the reddish tint of the woolly under-fur showing through the long outer hairs. An average sable will measure about 20 inches from the snout to the root of the tail; the length of the tail being 7 inches. The skins are valued only when they have their winter fur, the summer coat being much shorter. In spring, although the winter fur may still be retained, the skins are quite useless, as the hair will drop off even after the skins have been dressed.

Distribution. The range of the sable originally extended from the Ural Mountains to Behring Sea, and from the mountains on the southern borders of Siberia to the 68th parallel of north latitude. It is, however, now much curtailed, owing to the incessant persecution to which the animal has been so long subject; and the chief haunts are now the mountain forests of North Asia, more especially Eastern Siberia and Kamschatka.

Habits. According to reports furnished to Dr. Guillemard by a native hunter, it appears that sables are for the most part of nocturnal habits, and, though they occasionally feed by day, generally spend that period of the twenty-four hours in holes at the roots or in the trunks of trees. They dislike the presence of man, and are rarely to be found in the neighbourhood of the

villages; their favourite resort being the depths of the forest least frequented by the natives. It is considered that the most inaccessible and least known parts of the country are the best hunting-grounds. They live on hares, birds of all kinds, and, in short, almost every living thing they can kill, but they are also said to eat berries, and even fish. There are, indeed, but few animals, apparently, which do not live on fish in Kamschatka. They have only one litter during the year, generally in the month of April, and bring forth four or five young at a birth in a nest in the holes of trees. The same writer tells us that whereas formerly a large number of sables were caught in traps in Kamschatka, they are now more generally hunted there with dogs; these dogs being specially trained for the purpose, and either running down their quarry on the deep snow, driving them into trees, or smelling them out when lying asleep in holes. The great object in

THE SABLE ($\frac{1}{4}$ nat. size).

such hunts is to "tree" the sable, when the tree is surrounded with nets, and the animal either shaken from the boughs or knocked off them by means of poles. If the sable does not fall into the nets, it is again pursued by the expectant dogs, by whom it is either run down, or once more "treed." When the tree is too high to allow of the sable being dislodged by the usual methods, it is either felled, or the animal is shot; but recourse to guns is if possible avoided, as the shot does damage to the skins. If the distance they have to travel be a long one, the Kamschatkan hunters start on their winter expeditions after the sable towards the end of September; but, if the district is nearer, they wait until the first fall of snow or about six weeks afterwards. If a single hunter takes skins in a season, he considers himself fortunate; but Dr. Guillem, that in a little-known district one party bagged upwards of 140 skins. The total number annually taken in Kamschatka must be very large; the number exported in the year 1882 from Petropaulovsky (which receives the i.

two thousand. The price of a single sable skin in St. Petersburg ranges from £2 to £25, according to its quality and condition. The Kamtschatan peasant receives an average of sixteen roubles for each skin; and this he has to take out in kind.

American Marten. This species (*M. americana*) is so nearly related to the pine-

Marten. marten and the sable that there may be a question whether it should be regarded as anything more than a variety. The long hair is very like that of the pine-marten, to which it is most nearly allied; its general colour being more or less uniformly brown, the breast-spot yellow, and the head and ears grey or whitish.

It is found in the Hudson's Bay district, Labrador, Alaska, and other parts of North America, descending on the eastern side as far south as the Adirondack Mountains, near New York.

In habits it appears to be similar to the pine-marten. In the Adirondacks it inhabits the evergreen forests, and is chiefly, although not exclusively, nocturnal. Its food consists of partridges, rabbits, and other smaller rodents, birds' eggs, young birds, frogs and toads, and large insects. It is said to display a distinct preference for forests of conifers, and is thoroughly arboreal, never venturing into the neighbourhood of human dwellings. Although generally gentle-looking in appearance it is related that when attacking animals larger than itself, such as hares, it becomes as fierce in demeanour, in proportion to its size, as a tiger. When one is seen among the tree-tops, the hunter has but to whistle and thus attract its attention, when it will afford a ready shot.

The fur is of great commercial value; the best skins selling at about £3, 15s. each. Of recent years the annual imports into this country have exceeded 100,000. Curiously enough, at certain periods this species becomes exceedingly scarce; the periods of scarcity recurring with great regularity at intervals of about ten years. How the animals disappear is, however, unknown, since there is no region into which they can migrate without the knowledge of the hunter, and none are found dead. The best season for obtaining the skins is in November; the animals being generally caught in wooden traps, which are set in lines for miles across the country. In spite of the incessant persecution to which it is subject, it does not appear that this species has appreciably diminished in number in the wilder regions of its habitat.

Fisher Marten. The largest of all the martens is the so-called fisher marten (*M. pennanti*), an animal rejoicing in a number of names—both popular and scientific—being variously designated as the “pekan,” “Pennant's marten,” “black fox,” and “black cat.” The two latter titles are due to the large size, stout build, and dark colour of the animal, which in point of form may be more aptly compared to a fox than to a weasel. It measures from 24 to 30 inches from the tip of the snout to the root of the tail. Its general colour is blackish brown, becoming grey on the head and neck; while the throat is distinguished by the absence of the light-coloured patch distinctive of all the other species. It ranges over the greater part of North America, as far northwards as Alaska and the Great Slave Lake, while to the southwards it is found in the upper part of Texas and about latitude 35°. Continual hunting has, however, exterminated the animal from the more settled districts of the United States east of the Mississippi.

Habits. Dr. Hart Merriam observes that "the name of fisher is somewhat of a misnomer, for these animals commonly frequent deep swamps and wooded mountain sides, away from the immediate vicinage of water, and are not known to catch fish for themselves as do the mink and otter. However, they are fond of fish, and never neglect to devour those that chance to fall in their way. They prey chiefly upon hares, squirrels, mice, grouse, small birds, and frogs, and are said to eat snakes. They also catch and feed upon their own congener, the marten, and make a practice of devouring all that they discover in dead-falls and steel-traps." It also appears that porcupines compose a considerable proportion of their food in some districts; specimens being sometimes killed with numbers of porcupine-quills in their skin and flesh. Curiously enough, these needle-like quills, which often exceed $2\frac{1}{2}$ inches in length, seem to cause it but little or no inconvenience. Instances are recorded where the fisher marten has attacked and routed such a comparatively large animal as the raccoon.

In its chiefly nocturnal and largely arboreal habits the fisher marten resembles most of the other members of the group; its agility in the forests is, however, very remarkable, and when much frightened, or in pursuit of prey, it has been known to leap from tree to tree. The nest is usually built in the hole of a tree at a great height above the ground; the young being generally from two to four in number, and produced at the end of April or beginning of May.

The fisher marten is trapped for its skins in the northern parts of America from October till May, those captured in the early part of the season being in the best condition. The fur is not nearly so valuable as that of the American marten; the usual price being about a dollar and a half per skin. In the European markets the fur is generally known as Virginian polecat.

Indian Marten. Readily distinguished from all the other species by its more brilliant coloration, and the greater relative length of the tail, which is fully equal to two-thirds that of the head and body, the Indian marten (*M. flavigula*) is the handsomest member of the group. The soles of the feet are, moreover, at least partially naked, although this character is less marked in Himalayan specimens than in those from more easterly regions.

The fur is generally short, although longer in the Himalayan than in other examples, and has a thick, woolly under-fur during the winter. There are two varieties of this animal, one of which is more brightly coloured than the other. In the former, or common Indian type, the upper part of the head and neck, the rump, the tail, and the limbs, are either glossy blackish brown or black; while the middle of the back is of a paler brown, sometimes with a whitish tinge. The chin and upper part of the throat are white, while the lower throat and chest are either of a brilliant orange, brownish yellow, or pure yellow tint. In the second variety, with the exception of the white chin and throat and the pale yellow chest, the whole of the fur is dark brown. The length of the head and body varies from 20 to 22 inches, and that of the tail, inclusive of the hair at the tip, from 17 to 20 inches. According to Mr. Blanford, the Indian marten is found throughout the Himalaya, from the regions to the westward of Kashmir to Eastern Assam, and thence through the hilly districts of Burma to the Malay Peninsula and Sumatra. In Peninsular India it occurs on the Nilgiri and Travancore Hills; whilst to the

eastward its range extends as far as South China and Amurland. It is always found at a considerable elevation above the sea-level, ranging in the Himalaya up to seven thousand or eight thousand feet; and its occurrence in ranges so remote from one another as the Himalaya and Nilgiri would seem to indicate a former colder condition of climate in order to have enabled the animal to have traversed the intervening hot districts.

This marten is only found where the hills are thickly clothed

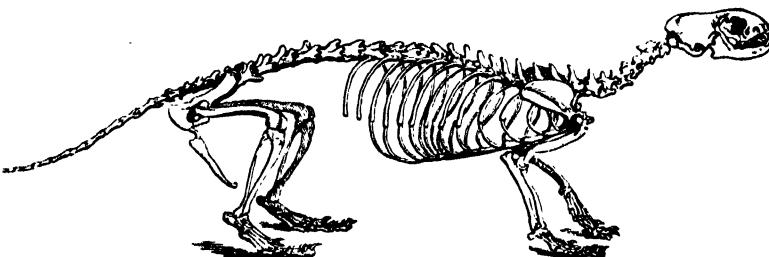
Habits.

with forest, and is by no means exclusively nocturnal. Although apparently far from uncommon in the Himalaya, it is, according to the writer's personal experience, but seldom seen. He had, however, once the good fortune to see a pair of these handsome animals descend from the trees, and gambol in a forest-glade at a short distance from his position. Other observers state that it may sometimes be seen in parties of five or six, hunting for prey either among brushwood or on the branches of trees. The late Prof. L. Adams states that, when on the move, it is continually uttering a kind of low chuckle, prolonged into a harsh cry when it becomes excited. Its food, which includes large insects, appears to be very similar to that of the other martens, but it is reported to kill young deer. It is noteworthy that a fossil marten, probably nearly allied to this species, occurs in the Pliocene strata of the Siwalik Hills of Northern India, and is thus the oldest representative of the group yet known.

With the well-known European polecat (*M. putorius*), we come

Polecat. to the first representative of the second great group of the genus *Mustela*, or that which includes the polecats, weasels, stoats, and minks.

As already mentioned, the chief characters by which these animals are distinguished from the martens are the absence of the first pair of premolar teeth



SKELETON OF THE POLECAT.

in both jaws, the sharper cusps on the crowns of all the cheek-teeth, and the absence of a cusp on the inner side of the blade of the flesh-tooth in the lower jaw. The members of this group are, moreover, of smaller size than the martens, and have, as a rule, longer bodies and proportionately shorter legs; and, whereas the martens give but little smell, the animals remaining for consideration are of ill reputation in this respect—as testified by the old name of foumart (foul-marten) applied to the polecat.

The common polecat is the best known representative of a small group of five species, distinguished from the stoats and weasels by their larger size and more powerful build. In length the head and body usually measure about 17 inches, while that of the tail is 6 inches. The nose is rather sharp, the small

ears are rounded, the neck is relatively long, and the tail is bushy. In colour the long hair of the body and limbs is brownish black or black, darkest on the head, tail, feet, and under-parts; while the ears are white, and there are some brown and white markings on the face and mouth. The woolly under-fur is a pale yellow, or fulvous, and by showing through the long hair communicates a general brown tinge, mingled with yellow, to the whole pelage; the tint varying considerably in different individuals. The fur is very long and loose on most parts of the body, and is commercially known as "fitch," from the name Fitchet, or Fletcher, applied in many parts of the country to this animal. The range of the polecat includes the greater part of Europe, extending as far northwards as the southerly districts of Sweden and the White Sea, but not including the Mediterranean countries.



THE POLECAT ($\frac{1}{2}$ nat. size).

In Western and Northern Asia it is replaced by the closely-allied Siberian polecat (*M. eversmanni*), which appears to be distinguished mainly by the head and back being nearly white, and by certain differences in the form of the skull. A third nearly-allied kind is the Tibetan polecat (*M. larvata*), inhabiting Ladak and Tibet, which differs only from the last by certain features in the base of the skull.

Sarmatian Polecat. The Sarmatian polecat (*P. sarmaticus*) is, however, a very distinct species, of rather smaller size than the common kind, and well distinguished by the fur of the under-parts being of a glossy black, while that of the upper parts is a mixture of brown and yellowish white. This species, often known as the mottled polecat, presents, therefore, another instance of that peculiar distribution of dark and light colours which we have already alluded to as characteristic of several members of the family. It is found in South-East Europe,

northwards from Poland, whence it extends into Western Asia, where it is common in the neighbourhood of Kandahar.

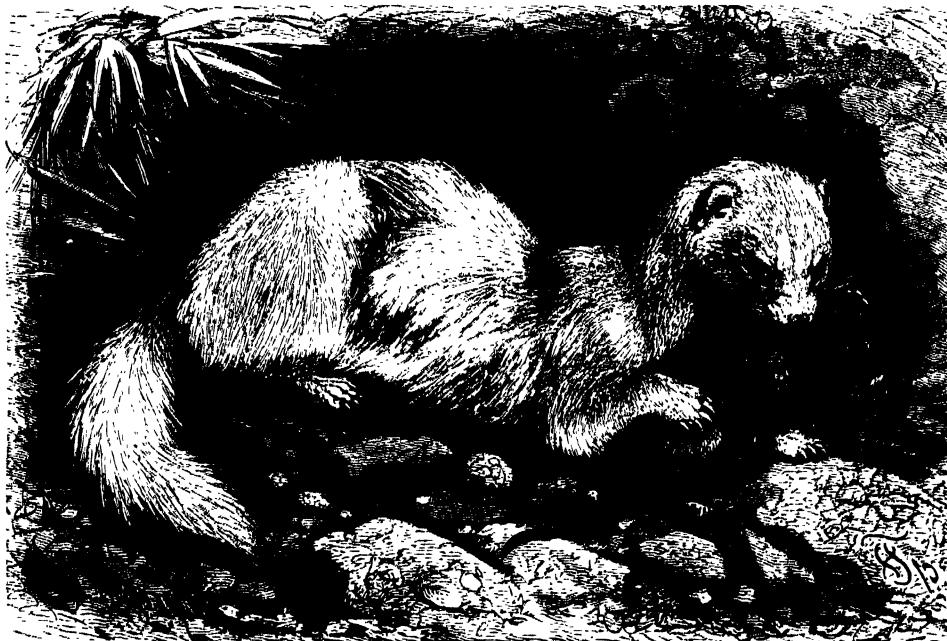
Black-Footed Polecat. Lastly, we have the American, or black-footed polecat (*M. nigripes*), which is generally of a brownish-white colour, with the feet, the tip of the tail, and a broad stripe across the forehead, black. It is larger than the common species; the length of the head and body measuring 19 inches, and that of the tail, with the hair at the end, 5½ inches. It inhabits the central plateau of the United States, ranging as far south as Texas.

Habits. The habits of all these five species of polecat appear to be very similar, and the whole of them are characterised by their extremely fetid odour. From the barren nature of the country which it inhabits, the Tibetan polecat probably, however, dwells among rocks and stones; while the Sarmatian species generally resides in the deserted burrows of other animals.

The common polecat, whose habits will in the main serve to illustrate those of the other species, is chiefly a nocturnal animal, lying concealed during the day in woods, in fox or rabbit holes, woodstacks, or among rocks, and issuing forth at evening for its devastations. In winter it frequently seeks shelter in old farm-buildings or outhouses. It is far less arboreal in its habits than the martens, and is also less active in its ways. The polecat is a deadly enemy to hares, rabbits, and partridges, and equally destructive to all kinds of domestic poultry, from the pigeon to the turkey; while in addition to the smaller mammals and birds, it will consume eggs, lizards, snakes, and frogs. It is stated on good authority that it always carries away its food to its lair; this would be obviously impossible with such large birds as geese and turkeys, which are, perhaps, merely killed for that insatiable thirst for blood, which is its characteristic. Indeed, wherever a polecat gains access to a poultry-house, the owner will be pretty sure to find the majority of the occupants lying dead in the morning. The polecat is, moreover, a no less deadly enemy to the game preserver; the authors of Bell's *British Quadrupeds* remarking that "the destruction which it occasions among the eggs and young of pheasants and partridges, young hares and rabbits, is incalculable; and, in the latter case particularly, it follows these animals into their burrows with such facility that a single family of polecats would shortly produce a sensible diminution in numbers amongst the denizens of a whole warren."

Fortunately, however, of late years its numbers have been vastly diminished, and it is now chiefly confined to regions with thick woods affording it comparatively inaccessible retreats. In the Alps it wanders in summer far above the limit of trees, although retreating to lower elevations in winter. The nest of the polecat is made in a deserted rabbit-hole, in the crevices of rocks, or amongst heaps of stones overgrown with brushwood or weeds; and here the young are born in the months of April and May, or, more rarely, the beginning of June. The number in a litter may vary from three to eight, although it is more usual to find four, five, or six. When captured early, the young may be easily trained for the purpose of rabbit-catching. Fossil remains of the polecat, like those of the weasel and the stoat, have been obtained from the cavern-deposits of this country and the continent, in association with the bones of extinct mammals.

Ferret. After much discussion and difference of opinion, zoologists are agreed that the ferret is merely a variety of the polecat, somewhat modified by the effects of long-continued captivity. It is usually smaller and more slender than the polecat, and is generally of a yellowish white colour, with pink eyes, but there is also a brown variety known as the "polecat-ferret." Ferrets are bred chiefly for rabbit and rat-hunting, both in Europe and the United States. Although they learn to know their masters to a certain extent, they are untrustworthy animals, and should be handled with caution. The ferret has no strong local attachments, and, therefore, requires to be strictly secured. It is also very susceptible to cold. As is the case with many domesticated animals, ferrets are more prolific than their wild allies, the number in a litter usually varying



THE FERRET ($\frac{1}{3}$ natural size).

from five to ten. The young are born in the spring; but it is said that there may sometimes be two litters in the year.

In rabbit-catching the ferret is usually sent into the hole either muzzled or attached to a coil of string, by which it can be withdrawn. If allowed to enter a rabbit-hole unmuzzled, or without a string, ferrets are very likely to remain in such good quarters, and to slaughter the occupants one after another. The usual plan is to stop all the entrances to the burrows by means of small bag-like nets, in which the rabbits are caught when they bolt; but sometimes they are allowed to bolt freely, and are either shot or coursing with dogs. In ferreting it is essential that those who are present should be perfectly silent, as otherwise the rabbits will prefer to be eaten alive by the ferret in their holes rather than attempt to escape. It is also important that no one should stand immediately in front of the entrance to the hole. When a ferret enters a burrow in which there are several rabbits, a

prodigious scuffling and scurrying immediately takes place in the interior ; and after a few minutes, if not frightened by sounds above, the occupants soon begin to bolt in rapid succession at the various exits. Like the other members of its tribe, a ferret almost invariably seizes a rabbit immediately behind the ear.

Weasel. The common weasel of Europe (*M. vulgaris*) is the first of several species, distinguished from the polecats by their smaller size, longer bodies, and the much slighter development of the ridges and crests on their skulls. The difference in the proportionate length of the weasel and the polecat will be made evident by comparing the figure of the skeleton of the former given on p. 46 with that of the latter on p. 58. Moreover, whereas none of the martens or polecats have a winter coat markedly different in colour from that which they wear in summer, the weasels and stoats in northern regions generally or invariably change their summer dress of brown for a white winter garb.

The common weasel, which ranges over the whole of Europe, Northern and Central Asia, and a large portion of the northern part of America, usually varies from 6 to 8 inches in length from the tip of the snout to the root of the tail ; the tail itself, with the hair at the end, varying from 2 to 2½ inches. In colour the upper-parts are usually some shade of mahogany brown in the summer dress, while the throat and under-parts are white, without any tinge of yellow. The outer sides of the limbs are coloured like the back, but it appears that the feet may be either of the same tint as the back or as the under-parts. There is considerable individual variation in the shade of the brown, as there is with regard to the limits of demarcation between the brown and the white areas. The tail is cylindrical and pointed, with its tip of nearly or exactly the same tint as the back. The female weasel is considerably smaller than the male, and appears to be the animal locally known as the cane.

In the northern parts of the whole extent of its range the weasel assumes a white dress in winter, although it appears that this change of dress is less regular than in its cousin the stoat, and requires a greater intensity of cold for its production. This change occurs but rarely in the British Islands. Even in the winter dress, the tip of the tail, although paler than ordinary, retains the reddish brown colour. In North America the weasel turns white in the northern parts of New England and the Adirondack Mountains near New York, but in the latitude of Massachusetts it retains the dark colour throughout the year.

Habits. The weasel, in suitable localities, may be found almost everywhere,—in hedgerows, woods, among stones, in water-courses, and along the edges of swamps. Its general food consists of small creatures, such as mice, rats, small birds, moles, shrews, insects, etc. ; but there is no doubt but that it will occasionally make inroads on poultry, and sometimes attack rabbits and sleeping partridges. The accusations of killing rabbits and hares habitually, which are so frequently levelled against the weasel, should, however, in most cases be transferred to the stoat. Indeed, from the war incessantly waged by the weasel against rats, mice, and voles of all kinds, it ought to be protected by the farmer, if not also by the gamekeeper, rather than ruthlessly destroyed whenever encountered. In spite, however, of these services, there is no doubt that the weasel does sometimes take to rabbit-hunting in good earnest ; and several will combine together in

companies the better to effect their object. Thus the late Richard Jefferies mentions that he has seen five, and heard of eight weasels together. "The five I saw," writes this observer, "were working a sandy bank drilled with holes, from which the rabbits in wild alarm were darting in all directions. The weasels raced from hole to hole, and along the sides of the bank exactly like a pack of hounds, and seemed intensely excited. Their manner of hunting resembles the motions of ants; these insects run a little way very swiftly, then stop, turn to the right or left, make a short *détour*, and afterwards on again in a straight line. So the pack of weasels darted forward, stopped, went from side to side, and then on a yard or two, and repeated the process. To see their reddish heads thrust for a moment from the holes, then withdrawn to reappear at another, would have been amusing had it not

THE WEASEL ($\frac{1}{3}$ nat. size).

been for the reflection that their frisky tricks would assuredly end in death." In another passage the same author graphically describes the chase of an unfortunate rabbit by a weasel—the timid fear and almost complete paralysis of the pursued through sheer terror, and the bold confidence of the bloodthirsty pursuer.

In all cases the weasel is a bold and inquisitive animal, exhibiting but little fear of man, and poking out its nose from some hole or cranny to survey his proceedings with the greatest indifference and self-possession. In spite, however, of this curiosity, the weasel is ever on the alert to withdraw its head at the slightest symptom of attack. When on the ground, weasels generally proceed in a series of small leaps, stopping at intervals to take a careful survey of their surroundings, and not unfrequently raising themselves on their haunches in order to obtain a better view. From its elongated, almost snake-like, body the weasel can follow most of the small mammals on which it preys to their holes or hiding-places. As Bell

observes: "It follows the mole and the field-mouse to their runs; it threads the mazes formed in the wheat-rick by the colonies of mice which infest it, and its long flexible body, its extraordinary length of neck, the closeness of its fur, and its extreme agility and quickness of movement, combine to adapt it to such habits, in which it is also much aided by its power of hunting by scent." The weasel is likewise an expert climber, seizing hen-birds while sitting in their nests, and thus gaining both parent and offspring, or eggs, at a single stroke. Although probably more prone to wander by night than by day, it can scarcely be regarded as a nocturnal creature, and may, indeed, as in the instance above recorded, be frequently observed hunting by day. Professor Bell states that the weasel brings forth four or more frequently five young, and is said to have two or three litters in a year. The nest is composed of dry leaves and herbage, and is warm and dry, being usually placed in a hole in a bank, in a dry ditch, or in a hollow tree. As is well known, the female weasel will defend her helpless young with great fury and desperation, risking her own life freely rather than leave them. Occasionally, too, the male will join in endeavouring to protect or carry off the young from danger.

Stoat. The stoat or, as it is generally called when in winter dress, the ermine (*M. erminea*), is closely allied to the weasel, from which it is chiefly distinguished by its superior size, and the black tip to the tail, which retains its colour when the rest of the fur turns white. On account of its superior size the stoat is frequently known as the greater weasel.

In summer the colour of the fur of the upper-parts of the stoat is dull mahogany brown, while the under-parts are of a pale sulphur yellow, and are thus easily distinguished from the pure white of the weasel. The length of the head and body is usually from 9 to 10 inches, but it may occasionally fall as low as 8 inches, or reach to 11; the length of the tail, with the hair, varying from about 3 to 5 inches.

Distribution. The distribution of the stoat is nearly the same as that of the weasel; the animal being widely spread over the northern regions of both hemispheres; it is, however, not improbable that the stoat extends into portions of the Western Himalaya, where its cousin is unknown. In all the more northern parts of its habitat the stoat invariably assumes the well-known white winter dress which constitutes the valuable ermine of commerce. In the British Islands this change always takes place in the Highlands of Scotland; while in the northern English counties, like Northumberland and Durham, it is frequent but by no means universal. Proceeding further south, the change of colour becomes more and more rare, taking place only occasionally in counties like Cambridgeshire and Lincolnshire, while in Cornwall and Hampshire it is almost unknown. In North America the change takes place in the more northerly of the United States and all the regions to the northward; specimens captured during the winter in Massachusetts, New York, and Pennsylvania being almost invariably white. Some of those from Virginia turn partially white, while in South Carolina there is no change at all.

Change of Coat. The nature of the change from the dark summer to the white winter dress in the stoat and other animals has given rise to much

discussion. It was originally considered that the animal sheds its coat in the autumn and spring; the dark summer coat being gradually replaced by the advent of the white hairs of the winter one. Doubts then arose whether the change in colour was always coincident with the development of the winter and summer coat, and whether the hairs themselves might not actually change colour. Dr. Elliott Coues succeeded, however, in proving that the change might take place in either way, some specimens taken in spring showing the long, woolly white winter coat on some parts of the body, while on other parts they had the short, coarse, brown hair of summer; and he observes that "we may safely conclude that if the requisite temperature be experienced, at the periods of renewal of the coat, the new hairs will come out of the opposite colour; if not, they will appear



THE STOAT OR ERMINE IN WINTER DRESS ($\frac{1}{3}$ nat. size).

of the same colour, and afterwards change; that is, the change may or may not be coincident with the shedding."

Dr. Coues attributed the reason of the colour-change entirely to the effects of temperature; but strong objection is taken to this view by Dr. Hart Merriam, who observes that it occurs in captive specimens kept continually in warm rooms. Dr. Merriam relies, however, chiefly upon the circumstance observed by himself and others that among the stoats of the Adirondack Mountains the winter change never takes place till after the first fall of snow, which generally occurs towards the end of October or the beginning of November. Although the temperature of the air may be much lower before than subsequent to this first snowfall, yet it is true "that ermine caught up to the very day of the first appearance of snow bear no evidence of the impending change. Within forty-eight hours, however, after the occurrence of the snowstorm the coat of the ermine has already commenced to

assume a pied and mottled appearance, and the change now commenced progresses to its termination with great rapidity. In early spring, the period for the reversal of this process, the changing back from the white coat of winter to the brown summer coat is determined by the same cause—the presence or absence of snow." These arguments appear conclusive that the change is really due to the necessity of the colour of the animal being adapted to its external surroundings; the change in captivity being owing to the influence of hereditary habits, which cannot be overcome in the short period during which the animals are under observation.

In habits the stoat is in general very similar to the weasel,

Habits. although from its larger size and greater strength it more commonly attacks larger animals, such as hares, rabbits, and poultry, than its smaller relatives. In America it is very fond of the ruffed grouse, and will often overcome the large northern hare; while its destruction of poultry is proved by a statement of Audubon to the effect that one has been known in a single night to slay upwards of forty well-grown fowls. When food is abundant, it is stated that the stoat only sucks the blood or eats the brains of its victims, leaving the flesh untouched. The late Richard Jefferies states that these animals usually hunt in couples, although occasionally three may be seen together; and that their range of destruction seems only to be limited by their strength.

The stoat hunts its prey both by day and by night, and is fully as good a climber as the weasel. Although it cannot in any way be considered an aquatic animal, there is good evidence to show that it is an excellent swimmer, and will, when occasion arises, take readily to the water. Its favourite haunts appear to be stony places and thickets, which secure it a safe refuge from its foes; and it is also very partial to patches of impenetrable gorse, while it will sometimes take up its abode in a deserted rabbit burrow. In spite of its destructiveness to poultry and game of all kinds there can be no doubt that from the number of rats, mice, and voles it consumes, the stoat is a benefactor to the farmer; and it is a remarkable fact that, whenever unusual numbers of any of the rodents above mentioned have appeared in any district, they have almost invariably been followed by a large assemblage of stoats and weasels who wage war upon them. It is almost superfluous to add that the stoat, when angered, emits a most noisome and penetrating smell.

The young in England are generally produced during the months of April and May, in a nest constructed in a hole in some dry bank. Prof. Bell states that the usual number of young in a litter is five; Dr. Coues states that the number may vary from a pair to as many as a dozen, although five or six may be taken as the average. In America the stoat has occasionally been employed in the same manner as the ferret for rabbit-catching, and appears to take to the work readily. In most parts of England stoats seem to be far less common than weasels, although the reverse is stated to be the case in Scotland.

The fur of such individuals as assume in Britain the white winter dress is always far inferior in quality to that of skins obtained from more northerly regions; the inferiority consisting in the shorter and thinner hairs, and the less pure and bright tint of the whole pelage. The importation of ermine skins into England was formerly very large, more than 105,000 having been landed in the

year 1833 ; but at a later period, owing to depreciation in value, the Hudson's Bay Company found that ermine skins were not worth the trouble of collection. At the present day the ermine is much more abundant in British North America and Alaska than it is in the United States ; the largest number of skins being obtained from Alaska.

In addition to the weasel and stoat, there are a number of more **Other Species.** or less closely-allied species inhabiting the Northern Hemisphere, while a few descend below the Equator. In North America, inhabiting the region of the Upper Missouri, we have the long-tailed stoat (*M. longicauda*), distinguished from the ordinary stoat by its longer tail. The Brazilian, or bridled weasel (*M. frenata*), is a more southerly species, ranging from Texas to Brazil, and distinguished by the head being darker than the body and blotched with white, and also by the retention of the dark colour throughout the year. A weasel from Patagonia may be only a variety of this species.

Asia also possesses a number of representatives of the group, such as the Himalayan weasel (*M. hemachelana*), in which the under-parts are brown and the tip of the tail dark ; the striped weasel (*M. strigidorsus*), of Sikkim, in which there is a pale stripe down the back ; the yellow-bellied weasel (*M. cathia*), from the Central and Eastern Himalaya ; the pale weasel (*M. alpina*), ranging from the Altai to Gilgit ; as well as several others, some of which are confined to Tibet.

Extinct Forms. Weasels were also well represented in past epochs of the earth's history, the remains of numerous species having been described from the Miocene or Middle Tertiaries of Europe. Of those referred to the existing genus *Mustela*, some differ from living weasels, and thereby agree with the larger martens, in having four pairs of premolar teeth in both jaws ; while others have four pairs of these teeth in the upper jaw, and only three in the lower jaw ; and others, again, have the reverse of this arrangement. Another extinct weasel-like animal from the same deposits, for which the name *Plesictis* has been proposed, is one of the forms already alluded to as apparently connecting the weasels so intimately with the civets.

Mink. The animal represented in the illustration on the next page forms one of a group of three species of comparatively large size, whose nearest allies are the polecats. The European representative of this group (*M. lutreola*), is generally known on the Continent as the nertz, or sumpf-otter (marsh-otter), and has no recognised English title, although the name of European mink has been suggested for it, and is adopted in this work. The second species is the true mink (*M. vison*) of North America ; while the third is the Siberian mink (*M. sibiricus*), which is stated to connect the other two with the polecats.

These three are distinguished from the other members of the genus, not only by their semi-aquatic habits, but by certain structural peculiarities. While agreeing with the polecats in the number of their teeth, the minks differ from them, as well as from the weasels, by the narrower muzzle to their skulls, being thus more like the martens. The premolar teeth are relatively larger than in their nearest allies ; while a more important point of distinction is

afforded by the partial webbing of the toes, which are also peculiar in possessing no long hair between their naked pads.

The European and North-American minks are such closely-allied animals that they cannot be even distinguished from one another externally; and in our own opinion it would be better to regard them as mere local varieties of a single species. The European mink has, however, very generally a white upper lip, which is but rarely exhibited in its American relative. When the skulls of the two forms are compared together it will be found that in the American form the upper molar tooth is invariably decidedly larger than in the European; and it is on account of this difference that the two are regarded as specifically distinct from one another.

Like the martens, the minks have a uniformly long and somewhat bushy



THE EUROPEAN MINK ($\frac{1}{3}$ nat. size).

tail, differing markedly from that of the weasels; its whole length being approximately equal to half that of the head and body. The ears are smaller than in any of the allied forms, and scarcely appear above the general level of the fur. The pelage consists of a dense, soft, and matted under-fur, mixed with long, stiff, and glossy hairs; the gloss being most marked in the fur of the upper-parts, while the hairs of the tail are more bristly than elsewhere. In colour the mink, according to Dr. Coues, varies from a light dull yellowish brown to a rich black chocolate-brown; the ordinary tint being a rich dark brown, scarcely, if at all, paler below than above. The tail is always decidedly blackish. Our illustration exhibits the white upper lip usually distinctive of the European mink. In both the eastern and western forms the chin is always white, although the extent of the white area is subject to individual variation. In addition to the white on the chin, there may also be small irregular patches of the same colour on the under-parts, while, as a rare abnormality, the tail may also be tipped with white.

As a rule, the American mink is somewhat larger than the European; and in both the male is always larger than the female. The American form may vary in length from the tip of the snout to the root of the tail from 15 to 18 inches; while the length of the tail, inclusive of the hair, ranges from about 8 to 9 inches. The European mink is an inhabitant of Eastern Europe, occurring at the present day in Poland, Finland, and the greater part of Russia, although unknown to the eastward of the Ural Mountains. The American species ranges over the greater part of North America, although not found in the extreme north of that continent.

In its general habits the mink, in both hemispheres, is thoroughly

Habits. amphibious, and is therefore only found in districts where water is abundant. Indeed, these animals may in this respect be regarded as presenting precisely the same relationship to the polecat as is held by the water-vole to the land-vole. The mink, writes Dr. Hart Merriam, "not only swims and dives with facility, but can remain long under water, and pursues and captures fish by following them under logs or other places from which there is no free escape. It has thus been known to catch as swift and agile a fish as the brook-trout, and Audubon says that he has seen a mink catch a trout of upwards of a foot in length. It is remarkably strong for so small an animal, and a single one has been known to drag a mallard duck more than a mile, in order to get to its hole, where its mate joined in the feast." Generally, the food of the mink consists of various aquatic creatures, such as frogs, crayfish, and molluscs; but it will also eat various small aquatic mammals, such as voles, as well as mice and rats, while in America it is reported to prey at times upon the comparatively large musquash. Marsh-frequenting birds also fall victims to the mink, and their eggs are probably also consumed. Other wild birds are, however, comparatively safe from the attacks of this animal, as its climbing powers are of the feeblest. Poultry are not unfrequently attacked; but in these and other attacks the mink does not exhibit that wholesale destructiveness characteristic of the stoat. In hunting, the mink has been often observed to pursue its prey entirely by scent; and it may be observed on its hunting expeditions both by night and by day.

As a rule, minks appear to be comparatively solitary animals, but Dr. Merriam mentions having once seen three in company. The abode of the mink is usually a hole in the bank of a stream or lake; and a well-trodden path always leads from the entrance of the burrow down to the water. From such abiding places it appears that the animal will not only make daily excursions for the sake of procuring food, but also wander into neighbouring districts, from which it sometimes does not return till after the lapse of a week or two.

The nests of the mink are situated either in the above-mentioned holes, or in hollow logs, and are generally well lined with feathers and other soft substances. The usual number of young in a litter is from four to six; and in the Adirondack region of New York these are born early in May, and remain with the female until the following autumn. In America minks have been extensively bred in a semi-domesticated state, for the purpose of being used as ferrets; and in this condition it appears that the number of young in a litter may vary from three to as many as ten. The scent characteristic of all the members of the weasel-group is extraordinarily developed in the mink, Dr. Coues observing that in America no

animal, with the exception of the skunk, possesses such a powerful, penetrating, and lasting effluvium.

All who have hunted the mink bear witness to its extraordinary tenacity of life, the writer last quoted stating that he has known several instances of these animals being found alive after having lain for fully four-and-twenty hours with their bodies crushed flat beneath a heavy log. The countenance of the mink is described as at all times far from prepossessing; but when caught alive in a steel-trap these animals are said to have an expression almost diabolical.

Some years ago the fur of the mink was but little esteemed, and

Fur. the price was at one time said to be so low as not to repay the cost of transport. Recently mink fur has, however, been more appreciated, and the animal has consequently been more vigorously trapped, with the result that in some districts there has been a considerable reduction in its numbers. In 1865 the value of a good mink skin was reported to have reached five dollars; and at that date upwards of 6000 of these skins were annually exported from Nova Scotia alone. It is stated that while for two decades the total number of European mink skins averaged 55,000, the exports of American mink reached 160,000; but in the year 1888 the number of American was upwards of 370,000. At the latter date the value of Russian mink varied from about one to four shillings per skin, while American skins fetched from four to ten shillings. Much higher prices were, however, current a few years previously. American mink always obtains higher prices than Russian, the best skins coming from Alaska and New England.

The Siberian mink is a little-known species inhabiting the **Siberian Mink** districts to the eastwards of the Yenesei River, but unknown in Siberia. It is more like a polecat in general appearance, having similar dark and light markings on the head and face. The colour is a clear rich tawny or fulvous brown, as dark below as above.

THE SOUTH-AFRICAN WEASEL.

Genus *Pœcilogale*.

The pretty little South-African weasel (*Pœcilogale albinucha*) is worthy of a separate heading, not only on account of its remarkable coloration, but also as being, with the exception of one species belonging to the typical genus *Mustela*, the sole representative of the weasels in Africa south of the Sahara. This species is distinguished from all the other weasels by having the ground-colour of the fur black, with the upper part of the head and neck white, and four pale brownish white stripes running along the back; the tapering tail being white. This peculiar coloration is almost precisely similar to that of the so-called Cape polecat, to be mentioned later on; and it may be that we have here another instance of true mimicry among mammals. In addition to its coloration, the species is also distinguished by having but two pairs of premolar teeth in each jaw, while very generally there is but a single pair of molar teeth in the lower jaw; and it is on these differences in the number of teeth that zoologists chiefly rely in referring this weasel to a distinct genus.

THE GLUTTON, OR WOLVERENE.

Genus *Gulo*.

The glutton (*Gulo luscus*), which is the only representative of the genus to which it belongs, is a very different-looking animal to any of the foregoing, from

THE GLUTTON, OR WOLVERENE ($\frac{1}{2}$ nat. size).

which it is likewise distinguished by its superior dimensions. In spite, however, of these differences, naturalists are in accord in regarding the glutton (or, as it is called in America, wolverene) as a member of the typical or weasel-like section of the family.

The glutton, which is an inhabitant of the northern regions of both the Western and Eastern Hemispheres, has the same number of teeth as in the martens; but these are unusually large and powerful, and distantly recall those of the

hyænas. The whole animal is heavily and rather clumsily built, and walks with the greater part of the soles of the feet applied to the ground. The limbs are thick and rather short; the feet are provided with long, curved, and compressed claws, and have their soles thickly haired. The back is much arched, and both the head and tail are carried low. Dr. Coues compares the whole appearance of the animal to that of a bear cub, with a superadded tail. The head is broad and rounded, with a rather short and pointed muzzle, small and widely-separated eyes, and small rounded ears, projecting but little above the general level of the fur. The tail is comparatively short, thick, and bushy, with hairs varying from 6 to 8 inches in length; and it has somewhat the appearance of having been truncated at the end. The fur of the body and limbs is rather coarse, long, and thick; and there is also a thick woolly under-fur. The general colour is dusky or blackish brown; but there is a distinct band of chestnut, or some lighter tint, commencing behind the shoulders, then running along the flanks, and meeting its fellow at the root of the tail. The front and sides of the head are light grey, while upon the throat and chest there may be one or more light spots. The limbs and under-parts, together with most of the tail, are very dark. The claws are nearly white. There is considerable individual variation in the size of the glutton, the length of the head and body in seven examples measured by Dr. Coues varying from $26\frac{1}{2}$ to 36 inches; and that of the tail, with the hairs at the end, from $12\frac{1}{2}$ to 15 inches. About 29 inches may, however, be set down as the length of the head and body in average-sized specimens.

In Europe the glutton appears to have been long regarded as a kind of fabulous creature; and it is remarkable that it is known by the same name—*vielfrass*—in almost all the continental countries. What may be the meaning of this name is uncertain; some writers considering that it is compounded of two Swedish words signifying rock-cat, while others refuse to admit its Scandinavian origin. By the French Canadians the animal is termed Carcajou, and by the English residents of British North America, Quickhatch; the latter, and probably also the former, being derived from some almost unpronounceable native name.

Distribution. The glutton is a forest-haunting animal, and in America is to be found in all suitable districts to the north of the United States as far as the Arctic coast, traces of its presence having been observed on Melville Island, in about latitude 75° . Its southern limits on the eastern side of the continent may be set down as about latitude 42° or 43° , or, roughly speaking, that of Lake Erie; but on the western side it descends lower, having been definitely recorded from Salt Lake, while in the mountains it may extend as far as Arizona and New Mexico. The animal is, however, now virtually exterminated throughout the United States. In Europe the glutton is found at the present day in Norway, Sweden, Lapland, the north of Russia, namely, in the neighbourhood of the White Sea, in the Government of Perm, and the whole of Siberia, and Kamschatka. In the time of Eichwald it was still to be found in Lithuania, but is now extinct there. Solitary specimens have, indeed, been killed in Saxony and Brunswick; but these must be regarded merely as stragglers, and not as indicating that the range of the species extended so far south within historic times. At an earlier period of the earth's history the glutton ranged, however, to the British Isles, its fossilised remains

having been discovered in the caverns of Derbyshire, Glamorganshire, and the Vale of Clwyd, while they also occur in the older "forest-bed" of the Norfolk coast. Evidence of the former existence of the glutton on the continent has also been obtained in the caves of the Dordogne in the south of France.

Habits. In habits the glutton is almost exclusively nocturnal, there being but few instances of its having been seen abroad during the day; and in two of these cases the animal was seen to sit up and shade its eyes with its paws, as if suffering from the unaccustomed light. The glutton does not hibernate, and there is no marked difference in the colour of the winter and summer coat. In spite of its clumsy-looking appearance the animal when disturbed can make off at a very rapid pace, and hunters who have occasionally seen a glutton in the shades of evening speak of the hopelessness of pursuing it. It likewise ascends rough-barked trees with facility, although it is said that its climbing powers are only exerted when it scents food. In the pursuit of prey the glutton will readily swim rivers. As a rule it is silent, although when attacked it will give vent to angry growls.

Gluttons are found either solitary or in pairs, but generally solitary. During the day they live concealed in subterranean holes, which are usually their breeding-places, and which are frequently the deserted lairs of bears. In North America the young are born in June or July, the number of individuals in a litter being, according to Coues, generally four or five, but it is stated that there are sometimes only a pair. The young remain with their mother till the following winter, when they have to shift for themselves. The Cree Indians state that the mother is exceedingly fierce when defending her offspring, and at such times will not hesitate to attack human beings.

In regard to food, it appears that the glutton will devour any animal that it can catch and overmaster, and that it is by no means averse to carrion. The activity of the animal is such that it can at times, according to Dr. Coues, capture such nimble prey as hares and grouse, while disabled or weakly deer are always successfully attacked. The stories of its attacking healthy full-grown reindeer are, however, improbable. Foxes, rabbits, marmots, etc., are dug out from their burrows and eaten.

Although much exaggerated by the older writers, the voracity of the glutton is extreme. It is stated by North American hunters that a freshly-killed animal may be safely left out in the woods for the first night, as the glutton will not touch it; but the second night the animal will return and gorge itself on the flesh, burying such portions as it is unable to consume. So pertinacious, indeed, are these animals in quest of slaughtered carcases, that they have even been known to gnaw through a thick log of wood and to dig a hole several feet deep in frozen ground, in order to gain access to the body of a deer concealed by hunters.

Gluttons are in the habit of robbing the traps set for other animals, and when one of them has discovered a line of marten traps the trapper may as well relinquish his trade until he has destroyed the marauder. Every trap along the line will be pulled to pieces and the bait or captured marten removed; and after the hunger of the glutton is satisfied the remainder of the booty will be buried. Another curious propensity of the glutton is its habit of stealing and hiding articles which can be

of no possible use to it; and one instance is recorded where these animals removed and concealed the whole paraphernalia of an unoccupied hunter's lodge, including such articles as guns, axes, knives, cooking vessels, and blankets.

Capture. Dr. Coues states that the glutton "may be captured in wooden traps similar to those used for martens, but of course made on a much larger scale, as the animal's strength is enormous, even for its size. The traps are sometimes built with two doors; but so great is the cunning and sagacity of the beast, that the contrivance for its destruction must be very perfect. The traps should be covered up with pine-brush, and made to resemble a *caché* as much as possible, as the wolverene is then likely to break in and get caught. The bait, ordinarily the conspicuous feature of a trap, must in this instance be concealed, or the animal will either break in from behind or, failing in this, will pass on his way. It is sometimes also taken in steel traps, or by means of a set gun, but both these methods are uncertain."

THE SKUNKS.

Genera *Mephitis* and *Conepatus*.

The handsome but ill-savoured skunks introduce us to the second great group of the present family, which includes the skunks, badgers, and their allies, and is characterised as follows. The feet are long, with straight toes, and the claws are blunt, but slightly curved and compressed, and quite incapable of retraction; those of the fore-feet being remarkable for their large size. The form of the molar tooth of the upper jaw is somewhat variable. Most of the members of this group are terrestrial and fossorial in their habits.

The skunks, of which there are several species, are an exclusively American group, of which all but one are referred to the genus *Mephitis*; our example on page 76 being the exception, and forming the genus *Conepatus*.

The typical forms have 34 teeth, of which $\frac{3}{4}$ are incisors, $\frac{1}{4}$ canines, $\frac{3}{4}$ premolars, and $\frac{1}{2}$ molars; and the whole of them are easily recognised by their large bushy tails, usually carried over the back, and their general black colour variegated with white stripes on the back; this coloration being another instance of the tendency of the upper part of the body to be lighter than the lower among many members of the family.

Common Skunk. The common skunk (*Mephitis mephitica*) is an inhabitant of Northern and Central America, ranging from Hudson's Bay in the north to Guatemala in the south, and it may be compared in size to a rather small cat, the length of the head and body always exceeding a foot, although there is considerable local variation in this respect. It is a stoutly-built animal, with a small head, short and rounded ears, a moderately-elongated body, and legs of medium length; the mode of walking being partially plantigrade. The long and bushy tail is thickly clothed with very long and fine hair, and is, as already mentioned, generally carried curled over the back when the animal is walking. Its length, inclusive of the hair, is somewhat less than that of the head and body. The general colour of the moderately long hair of the body is black or blackish;

and, although there is a great amount of individual variation, the white markings usually take the form of a streak on the forehead, a spot on the neck, and two stripes running down the back. The tail is black, more or less mixed with white, or merely tipped with the same. In some cases the white stripes do not extend beyond the neck, so that the back is entirely black.

Long-Tailed Skunk. The nearly-allied long-tailed skunk (*M. macrura*) from Mexico

Skunk. differs by its longer and more bushy tail, of which the whole length is not less than that of the head and body.

Lesser Skunk. More distinct is the lesser skunk (*M. putorius*), ranging from the southern United States to Yucatan and Guatemala. This species never exceeds a foot in length from the snout to the root of the tail, the whole tail being distinctly shorter than the head and body. It has four interrupted white stripes on the body, together with some spots, and the tail is tipped with white. There are also certain differences in the characters of the skull.

White-Backed Skunk. In South America the group is represented by a very distinct species known as the white-backed skunk (*Conepatus mapurito*), which is the one figured in our illustration. This skunk differs from all the others by its heavier build and more pig-like head and snout, in which the nostrils are directed downwards and forwards, instead of laterally. There are, moreover, important differences in the form of the skull and teeth, the latter being usually only thirty-two in number, owing to the absence of the first pair of premolar teeth in the lower jaw. Then, again, the ears are extremely small, and the tail is shorter and less bushy than in the other skunks. In size this species is the largest of the group, some specimens attaining a length of about 24 inches, exclusive of the tail, although the more usual dimension is about 18 inches. The colour is even more variable than in the common skunk, but in general the two white stripes on the back are very wide, and may either completely unite, or, as in our illustration, be separated merely by a narrow dark band, the tail being either pure white or black and white. The coloration of this species shows, therefore, very markedly the general light colour of the upper, as compared with the lower surface of the body.

The range of this species extends northwards from Patagonia and Chili through Central America to Texas.

Habits. Subject to certain modifications, engendered by their surroundings, the habits of all the species of skunks are very similar, and they will accordingly be treated of collectively.

Skunks are good climbers, but appear to prefer clearings and open glades rather than dense forests, and they may be frequently found in the neighbourhood of human dwellings; although in Patagonia and the Argentine pampas they inhabit perfectly open country. In common with other members of the family they are largely nocturnal, but may be met with walking abroad in the evenings in North America, while Darwin states that in Patagonia the white-backed species, "conscious of its power, roams by day about the open plains, and fears neither dog nor man."

This indifference to the presence of other creatures is, indeed, one of the most striking characteristics of the group, and is, as suggested in the passage cited, doubtless due to the immunity of attack which these creatures possess, owing to their nauseous secretion. Thus Mr. Belt states that in Nicaragua "the skunk goes

leisurely along at night, holding up his white tail as a danger-signal for none to come within range of his nauseous artillery." And Dr. Merriam relates that so indifferent is the common skunk to the presence of man, that in many parts of the United States these creatures are not unfrequently run over in the evenings on the roads by passing vehicles. The peculiar and conspicuous coloration of the skunks is generally regarded by naturalists as belonging to the class of so-called "warning colours." Such warning colours would seem, observes Mr. Poulton, "to benefit the would-be enemies rather than the conspicuous forms themselves. . . . But the conspicuous animal is greatly benefited by its warning colours. If it resembled its



THE WHITE-BACKED SKUNK ($\frac{1}{2}$ nat. size).

surroundings, like the members of the other class, it would be liable to a great deal of accidental or experimental tasting, and there would be nothing about it to impress the memory of an enemy, and thus to prevent the continual destruction of individuals. The object of warning colours is to assist the education of enemies, enabling them to easily learn and remember the animals which are to be avoided."

In the Adirondack region the chief food of the common skunk consists of mice, salamanders, frogs, and the eggs of birds that nest on or near the ground, while such hens' nests as are met with are sure to be robbed, and an occasional raid is made on the poultry-yard. A large number of beetles, grasshoppers, and other insects are likewise consumed by these animals.

Owing to its fearless and unsuspicious nature, the North-American skunk may be taken in almost any kind of trap; and these animals are often a considerable annoyance to the trapper owing to their habit of frequently entering the snares set for more valuable quarry. The skunk, observes Dr. Merriam, is slow in movement and deliberate in action, and does not often hurry himself in whatever he does. His ordinary gait is a measured walk, but when pressed for time he breaks into a slow, shuffling gallop. It is hard to intimidate a skunk, but when once really frightened he manages to get over the ground at a very fair pace.

The same writer further observes that in the Adirondack region skunks remain active during the greater part of the year, and hibernate only during the severest part of the winter. "They differ from most of our hibernating mammals in that the inactive period is, apparently, dependent solely upon the temperature. That the amount of snow has no influence upon their movements is evident from the fact that they are frequently out, in numbers, when its average depth exceeds five feet on the level. Neither can it be a difference in food-supply that affects them, for at this season they subsist almost entirely upon mice and shrews, and I have repeatedly noticed these little beasts scampering about on the crisp snow when the thermometer indicated a temperature below 20° F." In the more southern districts of North America skunks doubtless remain active throughout the year, and the same is probably the case with those inhabiting Central and South America.

The nests of these animals are formed either in holes in the ground, in hollow trunks of trees, or among rocks; and in the North-American species the number in a litter is usually from six to ten. The young are born in the spring, and generally remain with their parents as inhabitants of the same hole till the following spring, when they have to make way for a fresh family. Dr. Merriam states that if a trap be set at the entrance of one of these holes the whole family may commonly be captured, at the rate of one per night. Surprising as it may at first sight appear, the common skunk, especially when captured young, is said to make a pretty and agreeable pet, gentle in manners, and cleanly in habits; while the beauty of its fur makes its personal appearance highly attractive. Moreover, the flesh of these animals is said to be white, delicate, and highly palatable.

The secretion that has given the skunk such an ill name is contained in a pair of glands situated beneath the tail, and can be ejected at the will of the animal; such ejection taking place only when the creature is attacked or irritated. So forcibly can the fluid (which is of an amber colour) be ejected, that it will carry from a distance of 13 feet to a little over 16 feet. It appears that there is a marked difference in the intensity of the odour of the secretion in different individuals of the common skunk, which is probably in part due to the age of the animal, and in part to the length of time which has elapsed since the preceding discharge took place. When freshly ejected, the fumes from the secretion are pungent and acrid in the extreme, and are probably capable of producing extensive swelling of the respiratory passages. Dr. Merriam states that "when inhaled without the admixture of a large amount of atmospheric air the unhappy victim loses consciousness and breathes stertorously, the temperature falls, and the pulse slackens, and if the inhalation were prolonged the results would doubtless prove

fatal." It has been stated that the secretion is not only used as a means of defence but also as a means of attracting these animals towards one another. This, however, is strenuously denied by Dr. Merriam.

Of the lasting and pernicious effects of even a drop of skunk secretion, no more striking instance exists than one recently published by Mr. W. H. Hudson, who writes of the South-American species. This observer relates, as a not uncommon event on the Argentine pampas, that a settler starts one evening to ride to a dance at a neighbour's house. "It is a dark windy evening, but there is a convenient bridle-path through the dense thicket of giant thistles, and striking it he puts his horse into a swinging gallop. Unhappily the path is already occupied by a skunk, invisible in the darkness, that, in obedience to the promptings of its insane instinct, refuses to get out of it, until the flying hoofs hit it and send it like a well-kicked football into the thistles. But the fore-feet of the horse, up as high as his knees perhaps, have been sprinkled, and the rider, after coming out into the open, dismounts and walks away twenty yards from his animal, and literally smells himself all over, and with a feeling of profound relief pronounces himself clean. Not the minutest drop of the diabolical spray has touched his dancing-shoes. Springing into the saddle he proceeds to his journey's end, and is warmly welcomed by his host. In a little while people begin exchanging whispers and significant glances; . . . ladies cough and put their handkerchiefs to their noses, and presently begin to feel faint and retire from the room. Our hero begins to notice that there is something wrong, and presently discovers its cause; he, unhappily, has been the last person to remark that familiar but most abominable odour, rising like a deadly exhalation from the floor, conquering all other odours, and every moment becoming more powerful. A drop has touched his shoe after all."

Fossil Skunks. Fossil remains of skunks belonging to the same genus as the species still inhabiting the country are met with in the caverns of Lagoa Santa in Brazil, where they are accompanied by those of a number of other animals of totally extinct types.

THE CAPE POLECAT.

Genus *Ictonyx*.

As will be apparent at a glance from our illustration, the South-African animal, commonly known as the Cape polecat (*Ictonyx zorilla*), is so like a small skunk in coloration and general appearance that it might well be taken for a member of the same group. Although the number of the teeth in the present animal is the same as in the skunks, the teeth themselves are relatively smaller than in the latter, with smaller cusps, and are thus more like those of the polecat, between which and the skunks the Cape polecat appears to form a kind of connecting link. A skull of the present animal may be readily distinguished from that of a skunk by the upper molar tooth being smaller, instead of larger, than the flesh-tooth.

In size the Cape polecat agrees approximately with the true polecat, and has a somewhat similarly-shaped body, and proportionately short limbs. The head is

broad, and the muzzle long and sharp, while the ears are very small and rounded. The tail is comparatively long and bushy, and about three-quarters the length of the head and body; and the whole of the fur is relatively long and thick. The ground-colour of the fur is a glossy-black, marked with a variable number of white stripes and spots. Frequently, as in our illustration, there is a white spot between the eyes, and another over each of the latter; but sometimes all the three



THE CAPE POLECAT ($\frac{1}{8}$ nat. size).

are united. The hinder-part of the head is frequently white, and from this white area there are given off pure white stripes (separated by three narrow black ones), which unite near the tail; the upper part of the latter being also mostly white. In other cases, however, the whole of the hinder-parts of the head, the neck, and the anterior portion of the back are white.

Distribution. The Cape polecat ranges from the Cape to Senegal; but in Sennaar and Egypt it is replaced by another nearly-allied species (*I. frenata*).

It is probably the latter which, according to Brehm, ranges across the Isthmus of Suez into Asia Minor, and the neighbourhood of Constantinople.

Habits. These animals frequent rocky districts, hiding either in the clefts of rocks, or among bushes and trees, and are purely nocturnal. They feed on mice and other small mammals, birds and their eggs, and lizards and frogs; and in inhabited districts they destroy poultry. In their general habits they are unlike the martens and polecats, being unable to climb, and only taking to the water under compunction, although, when the necessity arises, they can swim well. Their great protection against their foes is their intolerable odour, which is described as being almost, if not quite, as offensive as that of the skunks. In many houses of the Dutch boers of South America tame individuals of the Cape polecat may be found, which are kept for the purpose of catching rats and mice.

THE FERRET-BADGERS.

Genus *Helictis*.

The ferret-badgers form a small group of four species from Eastern Asia, which in some respects serve to connect the preceding forms with the true badgers, having relatively longer bodies, shorter limbs, and longer tails than the latter. They are all of comparatively small size, and are distinguished from the other members of the badger-like group by having the under-surface of the body lighter coloured than the back. One species is further remarkable for the brilliant orange tint of the under-parts and portions of the head.

All these animals have the same number of teeth as the martens; the upper molar and flesh-tooth being remarkable for their broad and squared crowns. The head is elongated, and terminates in a prolonged and naked muzzle, with obliquely truncated nostrils; and the ears are small but distinct. The claws are very narrow, and about twice as long in the fore as in the hind-feet; the soles of the feet being naked. The tail, which is more or less bushy, may be either rather more or rather less than half the length of the head and body.

Of the four species, the brown ferret-badger (*Helictis orientalis*), in which the length of the head and body is 16 inches, and that of the tail, with the hair, 9 inches, inhabits the Nipal Himalaya and Java, and is characterised by its brown or yellowish brown colour, and its relatively long tail. The Burmese ferret-badger (*H. personata*), which differs in the greyish tint of the upper-parts, inhabits Lower Burma and Manipur, and probably some neighbouring districts. The two remaining species, viz. *H. moschata* and *H. sabaurantiaca* are from China. The latter is characterised by its relatively short tail, and the brilliant orange colour of the snout and the sides and the under-parts of the head and throat; the ears, a stripe down the neck, and the under-parts and feet being yellow. The upper-part of the head and face is chocolate-brown, forming a most marked contrast with the orange; while the back and tail are olive-colour.

Habits. The ferret-badgers are purely nocturnal, and differ from the other members of the present group in being able to climb with facility. The Indian species are almost omnivorous in their food, eating both

small mammals and birds as well as fruits and insects. All the species live in forests as a rule.

THE RATELS.

Genus *Mellivora*.

The ratels or, as they are frequently called, honey-badgers, are distinguished from all the members of the family hitherto noticed by their more badger-like shape, very short tails, and the absence of any external ears. They are aptly



THE CAPE RATEL ($\frac{1}{2}$ nat. size).

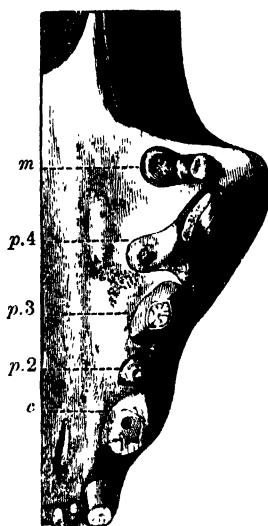
compared in gait and appearance by Mr. Blanford to small bears. There are but two living species, of which one is confined to India, and the other to Africa.

In addition to their short tails and the absence of external ears, the ratels are characterised by their stoutly-built bodies, and short, powerful limbs, of which the front pair are provided with enormous claws. They walk with the greater part of the naked soles of the feet applied to the ground. As regards coloration, they show in a most marked degree the peculiarity to which we have already referred as characterising many members of the family; that is to say, the under-parts are dark, and the upper-parts lighter. In the present instance, the whole of the

muzzle, together with the under-parts of the head, body, and tail, and the entire limbs, are black; while the upper portion of the head, body, and fore-half of the tail are whitish grey.

The skulls of the ratels may be distinguished by the small number of the large and powerful teeth. The total number is only 32, there being but three

pairs of premolar teeth in each jaw, and no tubercular molar in the lower jaw behind the flesh-tooth. The upper teeth, as shown in the figure of the palate of a fossil species, are characterised by the molar (*m*) being very narrow from front to back, and of the characteristic musteline dumb-bell-shape; and also by the flesh-tooth, or fourth premolar (*p.4*), being larger than the molar, with the tubercle on the inner side placed near the front edge. Moreover, in the lower jaw, the flesh-tooth has a very minute heel at its hinder end. The ratels may be compared in size to a badger, the length of the head and body of the Indian species varying from about 26 to 32 inches, and that of the tail, inclusive of the hair, from 6 to 6½ inches.



THE RIGHT HALF OF THE PALATE OF THE FOSSIL INDIAN RATEL.

molar tooth ; *p.4*, fourth

presence of a well-marked white line dividing the dark area of the under-parts from the grey of the back.

Both species are strictly nocturnal in their habits, and reside

Habits. during the day in burrows, which are probably excavated by themselves. The Indian species is most commonly met with in hilly regions, or along the high-scarped banks of the great rivers, which afford good situations in which to construct its burrows. Ratels generally go about in pairs, and feed on rats, birds, frogs, insects, and honey: while in cultivated districts they commit frequent raids on poultry. The accusation of digging up corpses from graveyards, which has earned for the Indian species the name of "Gravedigger" among Anglo-Indians, is, according to Mr. Blanford, probably unfounded. The African species exhibits a very strongly-marked taste for honey, together with the larvae of bees in the combs; digging out the latter from hollow trees by the aid of its powerful front claws. The account given by Sparrmann of the ratel's mode of operations when about to attack a bees' nest is not, however, to be wholly relied upon, since it is largely drawn from native sources of information.

In captivity ratels are easily tamed, and frequently exhibit a peculiar habit of turning complete somersaults each time they walk up and down the cages in which they are confined.

Distribution. The Indian ratel (*Mellivora indica*) is found from the Himalaya to Cape Comorin, but is unknown in Ceylon or to the eastwards of the Bay of Bengal. The African species (*M. ratel*) occurs throughout Africa, but more especially in the southern and western parts of the continent. Mr. Blanford has some doubts as to whether the African and Indian ratels are really entitled to be regarded as distinct species; but the former, as shown in our illustration on page 81, is distinguished by

Fossil Ratels. From the rocks of the Siwalik Hills of North-Eastern India, belonging to the Pliocene period, and likewise from formations of corresponding age in the Punjab, there have been obtained the remains of ratels closely allied to the living species; so that it may be concluded that India was the original home of these animals, and that thence they migrated into Africa.

THE AMERICAN BADGER.

Genus *Taxidea*.

The American badger (*Taxidea americana*) brings us to the first of four genera which may be collectively called badgers, and the whole of which are confined to the Northern Hemisphere. They all have the same number of teeth as in the martens, that is to say, 38, of which $\frac{3}{3}$ are incisors, $\frac{1}{1}$ canines, $\frac{4}{4}$ premolars, and $\frac{3}{2}$ molars on each side of the jaws. All of them have stoutly built bodies, and short limbs adapted for digging; while, with one exception, the tail is very short. They are further characterised by the unusually large size of the molar tooth of the upper jaw, and likewise by the elongation of the posterior heel of the flesh-tooth of the lower jaw.

In the American badger the skull is very wide posteriorly, the body depressed, and the tail very short. The skull may be at once distinguished from that of the true badgers by the proportionately larger size of the upper flesh-tooth, and the smaller upper molar, which is triangular in form, with the apex directed outwards. The fore-claws are enormous, the eyes are very small, and the muzzle is hairy right up to the obliquely truncated nostrils. The low, rounded, and broad ears are remarkable for the large size of their apertures. In length the animal, from the snout to the root of the tail, measures about 24 inches, and the tail 6 inches. The general colour of the coarse fur of the body is a blackish grizzle, mingled with either white, grey, or tawny, or the whole of these together, on the upper-parts, while below it is uniformly whitish, sometimes shaded with grey or tawny. The head is darker than the body, with a white stripe down the middle, and the limbs are blackish brown.

Distribution. The ordinary form of the American badger extends from British North America, from at least latitude 58° , over the greater portion of the United States. Near the Mexican border of the States, as in Eastern and Central Mexico itself, it is, however, replaced by a variety distinguished by a white stripe, sometimes interrupted, running down the back from the nose to the tail.

Habits. In habits the American badger appears to closely resemble the common European species, being strictly nocturnal, and living in burrows constructed by itself. In the colder portion of its habitat it hibernates. Although but very seldom seen, Dr. Coues states that these animals live in countless numbers in the region of the upper Missouri River and its tributaries; tracts of sandy soil being so full of their burrows as to render travelling on horseback dangerous. These badger-holes can be distinguished from those of the prairie-marmot by their larger size and the absence of a circular mound of earth at their entrance; though many such holes are merely burrows of the prairie-marmot,

which have been enlarged by the badger in order to capture the original excavator. This abundance of the American badger is doubtless largely due to its immunity from foes and the plentiful supply of food.

In addition to the various species of Rodents, which form its principal food, the American badger will also eat smaller animals,—even insects and snails,—while it is also partial to birds' eggs and to bees' nests with their honey and larvæ. In disposition it is shy and retiring, always seeking to avoid rather than to court danger. If brought to bay, it will fight with all the fierceness and stubbornness characteristic of its European cousin, and it also exhibits the same tenacity of life. In some parts of the Western States badger-baiting used to be as favourite a sport as it once was in our own country, but it is now discontinued.

But little appears to have been ascertained as to the breeding habits of the American badger, but it seems that three or four is the usual number in a litter. In British North America the period of hibernation lasts from October till April, and the animals are said to come forth after their long fast in good condition.

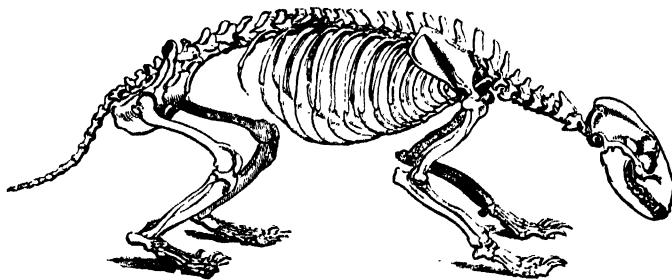
American badger fur is of some value, and is at times largely

Fur. used for robes, muffs, tippets, and trimmings; while a considerable quantity of the long hairs are employed in the manufacture of shaving and other brushes, although in many cases the hairs are too soft for this purpose. In 1873 the prices of American badger skins varied from one to seven shillings each in London; while three years later the price per skin for the best samples in New York was one dollar. At the present time, according to Mr. Poland, the price in London varies from six to twenty-two shillings.

THE COMMON BADGER.

Genus *Meles*.

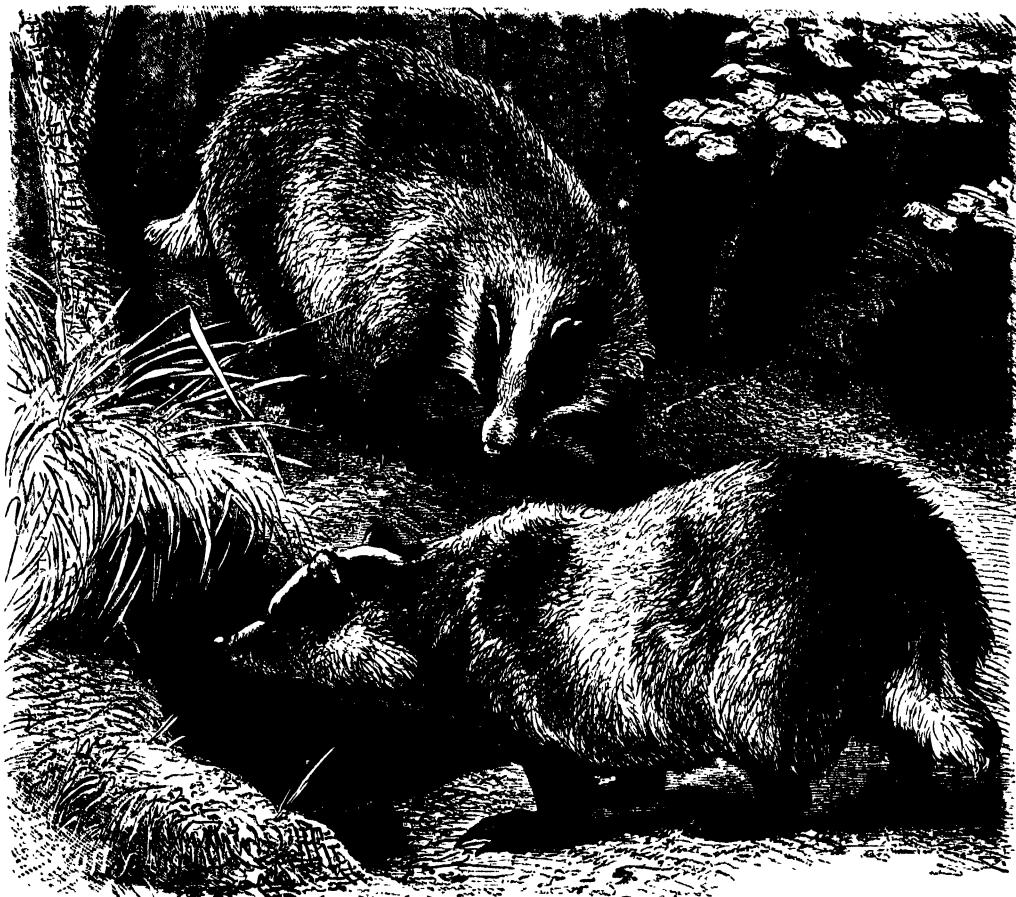
The common badger (*Meles taxus*) is the best known member of a group of five closely-allied species distributed over a considerable portion of Europe and Asia, although unknown in the Indian and Malayan regions. All these



SKELETON OF THE COMMON BADGER.

animals are readily distinguished from the American badger by the characters of the skull and teeth. The skull itself is characterised by the great height of the bony ridge running along the middle of the brain-case, and affording attachment for the powerful muscles which render the badger's bite so

severe. Then, again, the upper molar tooth, instead of being triangular and of nearly the same size as the flesh-tooth, is oblong in form, and very much larger than the latter, recalling in this respect the corresponding tooth of the bears; a further analogy with that group being presented by the small size of the first three premolar teeth. Another feature in which the true badgers differ from the American badger is to be found in the great development of the posterior heel of the lower flesh-tooth, which exceeds in length the whole of the remainder of the



THE COMMON BADGER ($\frac{1}{4}$ NAT. SIZE).

tooth, this expanded heel having to bite against the enlarged upper molar tooth. The skull of the badger is also peculiar on account of the close interlocking of the lower jaw with the skull proper, the articulation being so perfect that it is impracticable to detach the one from the other without fracture. Needless to say, it is, therefore, impossible for one of these animals to dislocate its lower jaw.

In general bodily conformation the Old World badgers very closely resemble their transatlantic ally; and their hairs are similarly banded with different colours, producing the well-known grizzled hue of the fur so characteristic of all these animals. The skin of the common badger is remarkably large and loose, enabling

the animal, when seized by almost any part, to turn and bite its aggressor; and the fur is long and loose. With the exception of a black stripe on each side, starting between the nose and the eye and running backwards to include the ear (of which the tip is white), the head of the badger is white. The lower jaw, throat, and all the under-parts, as well as the limbs, are black; while the upper-parts are reddish grey, and the flanks and tail light grey. The length of a full-grown badger from the snout to the root of the tail, will vary from about 25 to 29 inches, that of the tail being about $7\frac{1}{2}$ inches; and the weight has been estimated at from 25 to 30 lbs.

Distribution. The common badger or, as it used to be called in England, the brock, is distributed over the whole of Europe, with the exception of the north of Scandinavia and the island of Sardinia; and it is also widely spread over Northern Asia, where it ranges in Siberia as far as the river Lena. It is probably also this species which inhabits Syria; but it is at present uncertain where the range of the common badger in Western Asia terminates, and where that of the smaller and paler coloured Persian badger (*M. canescens*) of Eastern Persia commences. In China and other parts of continental Asia the group is represented by the white-tailed badger (*M. leucurus*) and the Chinese badger (*M. chinensis*); while a fifth species (*M. anacuma*) inhabits Japan.

Habits. On the continent, especially in many parts of Germany (where it is known as *dachs*), the badger is very common, and does much damage to the vineyards. In the British Islands, as we may judge both from the frequency with which its remains are met with in the cavern and other superficial deposits, as well as from the number of places in England, such as Brockenhurst and Brockley, which derive their names from this animal, the badger must once have been very commonly distributed. At the present day, writes Mr. J. E. Harting, "many people seem to be under the impression that the badger, if not actually extinct in the British Islands, is at all events a very scarce animal. This is far from being the case. In many parts of the country the badger is still not at all uncommon, and in certain districts which might be named it is even on the increase, owing to the protection afforded it. The reason for its supposed scarcity arises from two causes, firstly, the nature of its haunts, which are generally in the deep recesses of large woods, fox-covers, and quarries; and, secondly, the nature of its habits, which are shy and retiring, and chiefly nocturnal."

The favourite haunts of the badger are the deepest and thickest woods, or coppice-clad cliffs and quarries; and in such situations it digs a large and roomy burrow. Here it sleeps during the day, issuing forth at evening in search of food, and sometimes joining with its fellows in this quest; Mr. Harting having observed three badgers together in Gloucestershire, while the late Mr. C. St. John on one occasion saw no less than seven in company on the shore of Loch Ness. In the colder portions of its habitat the badger hibernates during the winter, the length of the hibernation depending upon the latitude and the degree of severity of the season. In England the hibernation appears to be always interrupted. Mr. Ellis, of Loughborough, who has a number of badgers on his estate, recently wrote that he has known one of the burrows covered with snow for a fortnight or more, during which time the animals remained below, and only ventured out when a thaw came. In Sweden it is stated that badgers generally retire about the middle of

November, and do not reappear till the middle of the following March, unless there should be a protracted thaw, during which they will sally forth in search of food. In order to afford additional security, the mouth of the burrow is blocked from the inside by its occupant. The burrow is always kept scrupulously clean, and is lined with fern and other vegetable substances; and Mr. Ellis states that "as the winter approaches, the old bedding is replaced by dry fern and grass raked together by the badger's powerful claws. This is often left to wither in little heaps till dry enough for the purpose. Partially concealed, I have watched a badger gathering fern, and using a force in its collection quite surprising."

The peculiar conformation of the upper molar teeth of the badger at once proclaims that the diet of the animal is by no means exclusively carnivorous; and Professor T. Bell states that its food "consists indifferently of various roots, earth-nuts, beech-mast, fruits, the eggs of birds, some of the smaller mammals, frogs, and insects." It is also ascertained that the badger is in the habit of digging up wasps' nests for the purpose of feeding upon the larvæ in the combs; and it has an equal partiality for the contents of the nests of wild bees.

It has been very generally asserted that badgers and foxes do not get on well together, and that the former kill the cubs of the latter. Mr. Ellis states, however, that, on his estate at least, "the badgers and the foxes are not unfriendly, and last spring a litter of cubs was brought forth very near the badgers; but their mother removed them after they had grown familiar, as she probably thought they were showing themselves more than was prudent." Mr. Harting also mentions more than one instance where these two animals have lived amicably together in the same burrow; in one of these cases a fox having annually given birth to cubs in the badger's den.

Within the deep recesses of its burrow, which often terminates in a fork-like manner, are born the young of the badger; the number in a litter being usually three or four. The young are produced during the summer; and are at first blind, not acquiring the power of sight till the tenth day. It is a curious, but apparently well-ascertained circumstance, that the female badger, like the roe-deer, has the power of extending the time of gestation considerably beyond the usual period.

Quoting once more from Mr. Ellis, that gentleman, writing in the autumn of 1877, states that on his estate "in June the first young badger appeared at the mouth of the earth, and was soon followed by three others, and then by their mother. After this, they continued to show every evening, and soon learnt to take the food prepared for them. The young are now almost full grown, and, forgetting their natural timidity, will feed so near that I have placed my hand on the back of one of them. The old ones are more wary, but often feed with their family, although at a more cautious distance. Their hearing and sense of smell are most acute, and it is curious to see them watch, with lifted head and ears erect, then, if all is quiet, search the ground for a raisin or a date. But the least strange sight or sound alarms them, and they rush headlong to earth with amazing speed." When taken young, badgers may be easily and perfectly tamed.

Hunting. The difficulty of "drawing a badger" when in a tub is well known, and tries the pluck of the best bred terriers to the utmost. It appears, however, that in Germany dachshunds usually bolt the badger from its

burrow, unless they are foiled by the creature digging deeper down and burying himself beneath the upturned soil. Other methods employed in Germany are either digging the animal out by following the course of the burrow, or by boring directly down upon it by means of a kind of gigantic corkscrew. Digging out is also sometimes resorted to in England, but the more common plan is to tie an empty sack, with a running noose round the mouth, in the entrance of the badger's burrow while the occupant is abroad, and then drive him in with dogs.

Fur. The fur and hairs of the common badger are used for the same purposes as those of its American cousin; but the hairs, being stiffer, are better adapted for brushes.

Fossil Badgers. It has already been mentioned that fossil remains of the common badger are met with in the cavern and other superficial deposits of this country; and it may be added that they also occur in those of the Continent. Beyond these, however, no fossil badgers have hitherto been met with, except in strata of the Pliocene period in Persia. When our comparatively full acquaintance with the extinct Tertiary Mammals of Europe and Northern India is taken into account, this remarkable absence of the remains of badgers is strongly suggestive that Persia or the adjacent regions must have been the original ancestral home of these animals, from whence they migrated westwards.

THE MALAYAN BADGER.

Genus *Mydaus*.

As being the sole representative of the badgers inhabiting the islands of the Malayan region, the curious looking animal depicted in the accompanying illustration may be appropriately designated the Malayan badger. It is known to the natives of Java as the Teledu, while by the Germans it is termed, on account of its evil odour, Stinkdachs; its technical name being *Mydaus meliceps*.

The Malayan badger forms a kind of connecting link between the true badgers and the under-mentioned sand-badgers, having a tail shorter than in the former, while its cheek-teeth are much more like those of the latter. It is a comparatively small animal, the length of the head and body being about 15 inches, and that of the stumpy tail only some $\frac{3}{4}$ of an inch. With the exception of the back of the head, the top of the neck, a stripe down the back, and the tip of the tail, which are whitish, the general colour of the long and thick fur is dark brown, but lighter below than above. There is a kind of crest of long hair on the back of the head and neck. The muzzle is long and pointed, and almost entirely naked in front of the eyes, with the flesh-coloured nostrils obliquely truncated and mobile. The Malayan badger appears to be confined to the mountains of Java, Sumatra, and Borneo, ranging in the former island from an elevation of about five hundred to upwards of seven thousand feet above the level of the sea. In Borneo it is found at elevations of not more than eighty or one hundred feet, and in Sumatra does not ascend above one thousand feet. It is a nocturnal and burrowing animal, not uncommon in some districts.

Horsfield, the original describer of this animal, says that when killed carefully,

and the scent-glands immediately removed, the flesh of the Malayan badger is quite free from odour, and far from unpalatable. The secretion of the glands is, however, foetid in the extreme, and has been compared to that of the skunks. As in the latter, it can be ejected by the animal to a considerable distance. We have but little information as to the habits of this animal in a wild state; but it is stated to be gentle and easily tamed when in captivity.



THE MALAYAN BADGER ($\frac{1}{4}$ nat. size).

THE SAND-BADGER.

Genus *Arctonyx*.

With the sand-badger or, as it is often termed, the hog-badger (*Arctonyx collaris*), we come to our last representative of the badgers, and at the same time of the present section of the Weasel family. The ordinary sand-badger is an Indian species, ranging from the Eastern Himalaya through Assam and the neighbouring regions to Tenasserim and Lower Burma. There is, however, also a smaller species (*A. taxoides*), inhabiting Assam and Arakan, and possibly China; while there is probably a third in Eastern Tibet.

The sand-badgers are easily distinguished from the other members of the group by their proportionately longer tails: that of the Indian species being from a quarter to a third the length of the head and body. The long and naked snout is very like that of the Malayan badger; the eyes are small, and the ears also small and rounded. The body is rather flattened from side to side; and only a portion of the naked soles of the feet are applied to the ground in walking, so that these animals may be described as digitigrade rather than plantigrade when in motion.

The pelage consists of a full soft under-fur, mingled with long stiff hairs. In colour the Indian sand-badger is dirty grey both above and below, with a more or less marked blackish tinge on the back, most of the individual hairs being dirty white throughout their length, but the longer ones on the back and sides having black tips. The head is white, with some variable black bands, while the lower parts and limbs are dusky, the limbs being sometimes black. Here, then, we have another instance of the tendency in the present family for the under-parts to be lighter than the upper regions. In length the Indian sand-badger measures about 30 inches from the snout to the root of the tail; the length of the latter, inclusive of the hair at the tip, being about 11 inches.

The most marked peculiarities of these animals are, however, to be found in the structure of their skulls. Thus the skull differs from that of any other mammals, except some of the edentates and dolphins, in having the bony palate prolonged as far back as the level of the cavity for the reception of the condyle of the lower jaw. The teeth are numerically the same as in the true badgers, but the upper molar tooth, instead of forming a regular oblong, has its hindmost outer angle excavated, so that the inner border of the tooth is much longer than the outer one. The first premolar tooth in the upper jaw is very minute, and is often soon shed.

Habits. Writing of the habits of the Indian sand-badger, from notes supplied by Colonel Tickell, Mr. Blanford states that it "frequents undulating stony ground or small hills among jungle, and lives in fissures of the rocks or holes dug by itself. It is thoroughly nocturnal. In captivity it is dull and uninteresting, feeding voraciously on meats, fish, reptiles, or fruits, and it is particularly fond of earth-worms. One individual used to pass the day sleeping in a hole that it had dug, and was very savage if disturbed. When angry it made a loud grunting noise and bit fiercely. It was dull of sight, and its only acute sense appeared to be that of smell. It was in the habit of raising its snout in the air in order to scent any one who approached, much as a pig does. This animal had no disagreeable smell."

THE OTTERS.

Genus *Lutra*.

The otters, which, with the sole exception of the sea-otter, are included in a single genus, constitute the third and last main group into which the members of the Weasel family are divided. They are characterised generally by their short and rounded feet,—although the hind-feet of the sea-otter are an exception in this respect,—their webbed toes, and their small, curved, and blunt claws. They all have very broad and flattened heads, furnished with small external ears, and joined to the long flattened body by a thick neck, which passes imperceptibly from the head in front into the trunk behind. The tail is moderately long, while the limbs are extremely short. The fur is soft, thick, and of a uniformly brownish colour over the whole body, except on the under-parts, where it is generally of a more greyish hue. The teeth of the otters are characterised by the nearly square form of the molar in the upper jaw, which, as shown in the accompanying figure, has its inner

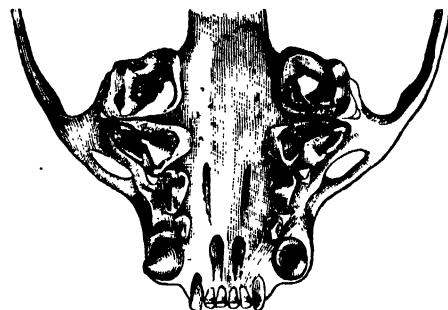
portion much expanded. All the species of these animals are thoroughly aquatic in their habits.

The typical otters, which include all the species except the sea-otter, are characterised by their hind-feet being of normal form, and by the number and structure of their teeth. As a rule, the total number of teeth is 36, of which, on each side of the jaws, $\frac{2}{3}$ are incisors, $\frac{1}{3}$ canines, $\frac{2}{3}$ premolars, and $\frac{1}{2}$ molars. The first premolar tooth in the upper jaw is, however, always very small, and in some species (as in the case of the palate here figured) may be totally wanting, thus reducing the number of the teeth to 34.

The general characteristics of the teeth of the upper jaw will be apparent from the figure, and it will be seen that the hinder teeth are furnished with a number of sharp cusps, admirably adapted to assist in retaining the slippery prey of these animals. In addition to the peculiar characters of the teeth, the skull of an otter may always be recognised at a glance by its extreme constriction immediately behind the sockets of the eyes, and the equally marked expansion of the flattened brain-case; the portion of the skull forming the face being also very short in proportion to the remainder. The tail is thick at the base, and somewhat flattened from above downwards. In most cases there are short claws on all the feet, but in a few species they may be either rudimentary or absent.

In all parts of their organisation otters are admirably adapted for their particular mode of life; their elongated forms, with but slight constriction at the neck, being perfectly suited to glide through the water with the greatest ease and speed; their thick, dense fur forming a perfect protection against chill, and their teeth, as we have mentioned, being specially modified in order both to hold such slippery prey as fishes, and at the same time to pierce with facility their hard scales. Probably, in consequence of their precisely similar habits and mode of life, all the otters are so like one another that it is extremely difficult to determine the exact number of species, and scarcely any group has proved more puzzling in this respect to the systematic zoologist. It appears, however, that there are about ten species of true otters, of which one is European and Oriental, three are exclusively Oriental, two are African, and four American. The largest of all is the Brazilian otter, while the two smallest species are the feline otter of South America and the Indian clawless otter. The geographical distribution of the genus is wider than that of any other single Mammalian genus, with the exception of certain bats; otters having been obtained from all parts of the world except the Antarctic and Arctic regions, Australasia, and Madagascar. We shall allude to the various species of the genus according to their geographical distribution.

European Otter. The European otter (*L. vulgaris*), which is the one represented in our coloured Plate, is taken first, as being not only the type of the



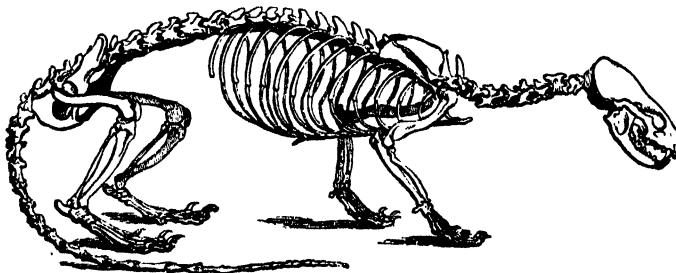
PALATE OF THE CLAWLESS OTTER.

The uppermost tooth on each side is the molar, immediately below which is the flesh-tooth.

genus, but likewise the best known; and many of our remarks on its habits will also apply equally well to the others.

In size this species occupies a kind of central position in the group, the average length from the snout to the root of the tail being about 26 to 28 inches, and that of the tail 15 to 16 inches, while the weight is from 16 to 18, up to as much as 24 lbs. The fur consists of a soft under-fur, in which the hairs are whitish grey, with brown tips, and of longer stiff hairs, which are greyish at the base, and rich brown at their tips on the upper-parts of the body and the outer surfaces of the limbs; the cheeks, throat, the under-parts of the body, and the inner surfaces of the limbs being brownish grey. The upper margin of the naked nose terminates behind in an angle, while, as in the other species, the muzzle is provided with long "whiskers." In the Indian variety, which was formerly regarded as a distinct species, the fur of the back is generally grizzled, while the size of the animal is slightly less than in the ordinary European form. The claws on all the feet are well developed, and there are four premolar teeth in the upper jaw.

Distribution. The common otter is found all over Europe in suitable localities, and also extends over a large portion of Asia northwards of the Himalaya. It is likewise represented by the ordinary form in the North-Western

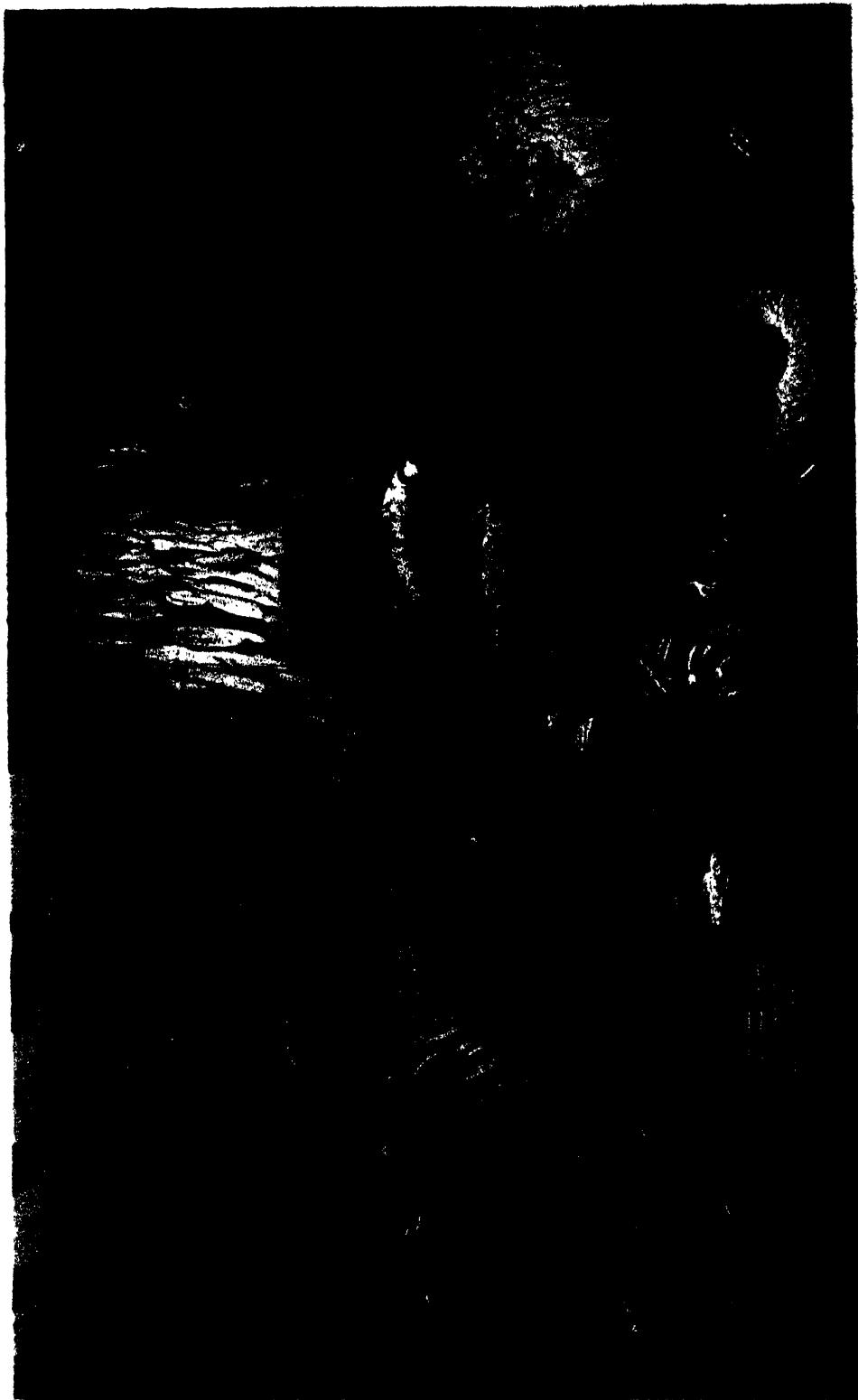


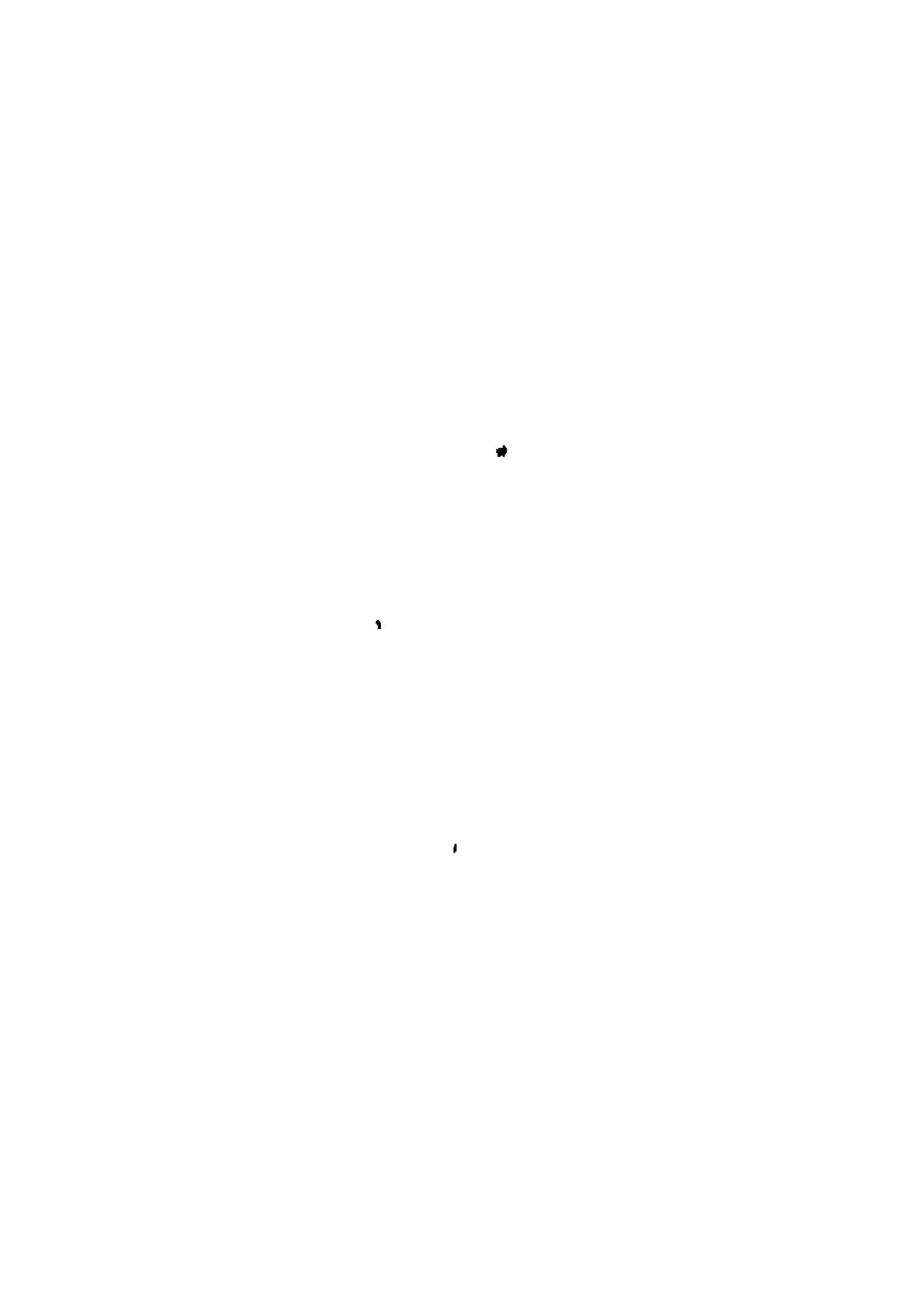
SKELETON OF THE COMMON OTTER.

Himalaya, and by the above-mentioned smaller and greyer variety in India and Ceylon, as well as in some of the districts to the eastwards of the Bay of Bengal.

Habits. Writing of the habits of the common otter, Bell observes that "it swims and dives with great readiness, and with peculiar ease and elegance of movements; and although its action on land is far from being awkward and difficult, yet it is certainly in the water that the beautiful adaptation of its structure to its habits is most strikingly exhibited. It swims in nearly a horizontal position, and dives instantaneously after the fish that may glide beneath it, or pursues it under water, changing its course as the fish darts in various directions to escape from it, and, when the prey is secured, brings it on shore to its retreat to feed. As the otter lives exclusively on fish, when it can procure them, it frequents lakes, rivers, smaller streams, or ponds, and not unfrequently descends to the sea; and the havoc which it makes among the finny inhabitants is almost incredible. In feeding, it holds the fish between its fore-paws, eating first the head, and then downwards to the vent, leaving the tail." The fish actually eaten by the otter form, however, but a small proportion of those captured; this animal being one of those which appears to delight in killing for killing's sake. In India the

EUROPEAN OTTER





common otter is occasionally found in the large tanks so common throughout the country, and it is stated by Mr. Blanford to be common in the great backwaters off the Western Coast, and in the Chilka Lake of Orissa.

Otters are generally found either in pairs or in family parties of five or six individuals, the latter comprising the parents and their partially or full-grown progeny. Their habitations are usually made in or near the banks of the waters they frequent, the hollows beneath the roots of trees growing on a river's margin being especial favourites, while in hilly districts the clefts between rocks are selected, and where the soil is of an alluvial nature deep burrows, with several entrances, one of which usually opens beneath the water, are excavated in the banks. A large pile of loose stones, forming one of the piers of a timber bridge over the Indus above the town of Leh has long been the favourite resort of a colony of otters. The presence of numerous bones and scales of fish, as well as the peculiar web-footed tracks of the animals themselves, will always indicate whether or not an otter's den or "holt" is inhabited.

Otters apparently never hibernate, and in consequence must be hard pressed to supply themselves with food during the winter in the colder portions of their habitat. At such times they are asserted in inhabited districts to make occasional raids on the farmyard, where they have been known to kill poultry and, it is said, even young lambs and pigs. Water-fowl are probably also attacked at such periods, while it is stated that eggs are always acceptable to these animals. In addition to fish, otters are in the habit of eating frogs and such fresh-water or marine crustaceans as are found in the waters they frequent.

Although chiefly nocturnal,—more especially in districts where they are much harassed,—otters may not unfrequently be seen hunting in the morning and evening, Mr. Blanford stating that he has frequently observed them in India at work up to nine or ten o'clock in the morning. When fishing, it appears that all the members of a party of otters are in the habit of combining their efforts to surround or drive a shoal of fish. General M'Master had on one occasion the good fortune to observe a party comprising at least six individuals thus engaged in the Chilka Lake of Orissa. "They worked," writes the narrator of the incident, "most systematically in a semicircle, with intervals of about fifty yards between each, having, I suppose, a large shoal of fish in the centre, for every now and then an otter would disappear, and generally, when it was again seen, it was well within the semicircle, with a fish in its jaws, caught more for pleasure than for profit, as the fish, so far as I could see, were always left untouched beyond a single bite."

The large size of the aperture in the skull below the socket of the eye for the transmission of the nerves supplying the muzzle, indicates that the "whiskers" of the otter must be extremely sensitive. With regard to their powers of hearing, smell, and sight, Mr. Blanford believes that, while the two former are well developed, otters are somewhat deficient in the latter. Their general intelligence is decidedly high, and they likewise often display much cunning and forethought, more especially in avoiding the traps set for their capture. When excited they utter a kind of yelping bark, and they are stated to give a sort of whistle as an alarm-note to their fellows. There is still a dearth of information as to the breeding-habits of the otter. It appears, however, that the young may be produced at any season of

the year, although the winter is the more usual time. The number of young in a litter generally varies from two to five, the cubs themselves being born blind.

The otter is readily tamed if captured at a sufficiently early age,

Tame Otters. and then becomes much attached to its owner, whom it will follow about after the manner of a dog. The natural instincts of these animals are taken advantage of by the native fishermen of some oriental countries to aid them in their avocations. The late Bishop Heber, when voyaging up one of the rivers of Bengal, states that his vessel passed "a row of no less than nine or ten large and very beautiful otters tethered with straw collars and long strings to the bamboo stakes on the banks. Some were swimming about at the full extent of their strings, or lying half in and half out of the water; others were rolling themselves in the sun on the sandy bank, uttering a shrill whistling noise, as if in play. I was told that most of the fishermen in the neighbourhood kept one or more of these animals, who were almost as tame as dogs and of great use in fishing, sometimes driving the shoals into the nets, sometimes bringing out the larger fish with their teeth." According to later authorities it appears, however, that the bishop was misinformed as to the otters being employed to catch fish with their teeth, their sole use in India being to drive the latter into the nets. In China, on the other hand, otters are actually employed in the former operation.

Otter-hunting in England has been already alluded to briefly

Hunting. under the head of the otter-hound; and from the facts there mentioned it will be gathered that these animals are still fairly numerous in many of the wilder parts of the country.

Otter fur, from its close texture, fine gloss, and rich colour, is

Pelage. much esteemed as a trimming, and commands a rather high price in the market. A large number of the otter skins imported into this country belong, however, to the North American species. Skins of the European species vary from five to thirty shillings in price.

Fossil remains of the common otter have been obtained from the

Fossil Remains. superficial deposits and caverns of this country and the Continent, and likewise from the so-called "forest-bed" of the Eastern Coast, which is somewhat older. A fossil otter from the still more ancient Norwich Crag, belonging to the upper portion of the Pliocene period has, moreover, been identified with the present species.

North American This otter (*L. canadensis*) is distinguished from the preceding

Otter. by the much larger size of the naked area at the tip of the muzzle, which extends far above and to the sides of the nostrils, instead of being entirely confined to the space between them, as in the latter. According to Dr. Coues, it is very variable in point of size and colour. It may, however, attain a total length of 4 feet or more, while the general colour of the fur is liver-brown with a purplish gloss, the chin, throat, and under-parts being paler. This species occurs over the whole of North America in suitable regions, although apparently nowhere very numerous; its northern range extending along the Mackenzie and other rivers nearly to the Arctic Ocean.

Habits. There does not appear much that is especially noteworthy or

peculiar in the habits of this species. Dr. Hart Merriam states that in

the Adirondack region the number of fresh-water cray-fish consumed by these otters is enormous, this crustacean apparently forming as important a portion of their food as fish. The same writer also bears testimony as to the long journeys undertaken by the North American otter from river to river across country; these journeys mostly taking place during the winter. On such occasions they "go so fast that a man has great difficulty in overtaking them. On the ice they proceed by a series of what boys call 'a run and a slide,' that is, they make several jumps and then slide ahead flat on their bellies, as far as their impetus and the smoothness of the ice permit, and then do the same thing over again, and so on." A curious habit of this otter is its propensity for sliding down smooth and steep banks, either of snow or of mud. Such gambols have been watched by several observers, from whose accounts it appears that in winter the animals select the highest ridge of snow, on to the top of which they scramble, whence, as Dr. J. D. Godman writes, they give themselves an impulse with their hind-legs, and swiftly glide head-foremost down the declivity, sometimes for a distance of twenty yards. This sport they continue apparently with the greatest enjoyment until fatigue or hunger induces them to desist. A pair on a mud-bank made upwards of twenty-two slides before they were disturbed. The number of young in a litter is said to be usually two, although there may occasionally be either one or three. They are born about the middle of April, and during the summer and autumn the female is generally to be seen accompanied by her two young.

The fur of the otter is more valuable than that of any other

Pelage.

North American animal, and is in good condition from November till the spring, but is at its best period during the latter season. It is stated by Dr. Coues that the number of skins of the American otter exported by the Hudson's Bay Company to London in the year 1873 exceeded 11,000, while in 1891 the same company sold 8171 skins. The ordinary price varies from thirty to fifty shillings per skin.

These otters are usually caught in steel traps, which are set

Trapping.

beneath the water where one of the "slides" or tracks of the animals leads to the margin. Sometimes the trap is, however, placed at the top of the slide and covered with snow. In neither case is any bait used; but in all methods the greatest care is necessary that no traces of the trapper's presence should remain, as the otter has very acute smell and sight, and is exceedingly wary and cunning.

South America possesses at least three species of otters, of which the most noteworthy are the Brazilian otter and the feline otter. The Brazilian otter (*L.*

brasiliensis) is much the largest of all the living species, and is distinguished by the presence of a distinct ridge running along each side of the tail, whence it is often termed the margined-tailed otter. It inhabits the rivers of Brazil and Guiana, where it is known as the Ariranha. The length of the head and body is over 40 inches, while that of the tail is about 23 inches. The nose is completely covered with hair, and the general colour of the pelage is chocolate-brown, becoming lighter on the under-parts. The chin, as well as a large irregular patch on the throat, and some spots on the under-surface of the body are, however, whitish or yellow.

Habits. In some of the South American rivers these otters may be met with in large companies, and they differ from most other species in being purely diurnal, commencing their hunting with the dawn of day and continuing till nightfall. When in such companies, the otters utter a kind of whistling sound, which is said to have some resemblance to the mewing of cats. Hensel states that, when travelling on the Brazilian rivers in a canoe, the voyager, when shooting out from beneath the overhanging branches of a tree, may often see a number of black objects in the water, which at his approach tend to collect together. Careful observation will show that these are otters, but by the time the canoe has reached the spot where they were first seen all will have disappeared. Soon, however, the traveller's ears are struck by a peculiar snorting sound, and, as he looks around, he sees the water on all sides dotted with the dark heads of the giant otters, which, with a second snort, disappear again as quick as lightning beneath the surface.

Feline Otter. The feline otter (*L. felina*) is, on the other hand, one of the smallest members of the group, agreeing approximately in size with the Indian clawless otter. It is characterised by its relatively short face and its light and delicate teeth, the inner tubercle of the upper flesh-tooth being much smaller than in the other species from the same regions. This species also differs from other otters in being almost exclusively marine in its habits. In regard to its distribution, Mr. O. Thomas states that "in the Southern Hemisphere it extends to the Straits of Magellan, where its range meets that of the larger Brazilian otter. Thence northward it is exceedingly common along the coasts of Patagonia and Chili, where the complex labyrinths of gulfs and channels are highly favourable to its manner of life." It has been found in Peru and Ecuador.

In regard to the naked-nosed and flat-headed South American otters, intermediate in size between the two last species, there is still much uncertainty, but they are all provisionally included under the name of *L. paranensis*.

Smooth Indian Otter. In addition to the common European otter, which, as we have already seen, is represented by a variety in India, there are three Indian and Malayan representatives of the group. The first of these species is the smooth Indian otter (*L. macrodus*), readily distinguished from the common otter by the upper border of the naked portion of the muzzle forming a straight line, while the fur is very smooth and short. Then, again, the skull is less depressed and flattened, and the molar and flesh-tooth in the upper jaw are very large, the latter differing from the corresponding tooth of the common species by the larger proportionate size of the tubercular portion on the inner side of the blade. This otter is found all over India, and also extends to Burma, the Malay Peninsula, and Sumatra. Its habits appear to be very similar to those of the common otter, and, like the latter, it is trained for fishing.

Hairy-Nosed Otter. The hairy-nosed otter (*L. sumatrana*) is a very well-marked species from the Malayan region, distinguished, as its name implies, by the muzzle being completely covered with hair; the inner tubercle of the upper flesh-tooth being relatively small. A closely-allied extinct species (*L. palaeindica*) occurs in the Siwalik Hills of Northern India.

Clawless Otter. There is also the much smaller Indian clawless otter (*L. cinerea*), differing from the others not only by its inferior dimensions, but also by the rudimentary condition, or even total absence, of the claws. The upper teeth (shown in the figure on p. 91) are distinguished by the absence of the first premolar, and the great length from front to back of the molar tooth. Moreover, the whole skull is much shorter than in the other species. The length of the head and body of this otter varies from 22 to 24 inches, and that of the tail from 10½ to 13 inches. The clawless otter ranges from India through Burma and the Malay Peninsula and islands to China. In India it occurs in the Himalaya at low elevations, in Lower Bengal and the Nilgiri Hills of Madras, and perhaps also in Ceylon. It appears to be the only otter found in Java. According to Mr. Blanford, the habits of this otter are similar to those of the other oriental species.

African Otters. The whole African continent possesses but two members of the group under consideration. The first of these is the African clawless otter (*L. capensis*), from South and West Africa, which, while agreeing with the Indian clawless otter in the rudimentary condition of its claws, is distinguished by its greatly superior dimensions; being, next to the Brazilian otter, the largest representative of the whole group. Writing of this species, which he alludes to under another Latin name, the late Professor Moseley states that "amongst the animals which live on the Cape Peninsula, the clawless otter is worthy of mention; it is a very large otter, twice or three times as large when full-grown as the European one. It lives about the salt-marshes and lakes, and is tolerably common; it hunts, like the South American marine otter, in companies, but only of three or four. It has no claws on the fore-feet, having lost them by natural selection in some way or other, and on the hinder-feet the claws are wanting on the outer toes, and only rudiments of them remain on the middle ones. There are, however, pits marking the places where the claws used to exist. The webbing between the toes is also in this otter rudimentary; the beast altogether is very heavily built, with the head very broad and powerful. It appears to be an otter bent on returning to land habits."

Spotted-Necked Otter. The spotted-necked otter (*L. maculicollis*) is one of the smaller members of the group, with well-developed claws. It has a naked nose, and very long hind-feet; the colour of the fur being blackish brown, with yellow spots on the throat, chest, and underparts. This otter has been obtained from the Cape and Natal.

Extinct Otters. Reference has already been made to the occurrence of the common otter in the superficial deposits of Europe, and also of an extinct species allied to the hairy-nosed otter in the Siwalik Hills of India. In addition to these, there are numerous extinct otters in the Pliocene and Miocene deposits of Europe, some of which appear to connect existing forms with the martens and their allies. Another is remarkable as appearing to indicate affinities between the otters and the civets, and thus serves to confirm the previously-mentioned evidence as to the existence of some relationship between the now widely divergent families of the weasels and civets. The otter-like animal in question is distinguished from



THE LEFT UPPER
FLESH - TOOTH OF
AN EXTINCT INDIAN
OTTER.

The outer ridge (left side of figure) is broken.

all other members of the present family by having two molar teeth on each side of the upper jaw.

Especial interest must also attach to some giant otters from the Siwalik Hills of India, which were even larger than the existing Brazilian otter. An upper flesh-tooth of one of these otters is represented in the cut on page 97, which will give some idea of their dimensions. By comparing this figure with the corresponding tooth of the recent skull represented on p. 91, it will be observed that these gigantic Siwalik otters are distinguished by having three distinct cusps, instead of a crescentic cutting-edge on the inner tubercular portion of the upper flesh-tooth.

THE SEA-OTTER.

Genus *Latax*.

As we have already seen, the feline otter of South America is in the habit of frequenting the lagoons and bays of its native coasts rather than rivers, and these



THE SEA-OTTER ($\frac{1}{2}$ nat. size). (After Wolf.)

marine habits are still more characteristic of the animal known as the sea-otter (*Latax lutris*), which is regarded as forming a genus by itself.

The Sea-Otter has a total length of about 4 feet, of which 1 foot, or rather less, is occupied by the tail. In general appearance it is compared by Dr. Coues to one of the eared seals, a resemblance which is increased by the long and flipper-like hind-feet, quite unlike those of all other members of the family to which it belongs. The body has a bolster-like form, tapering in front to join the rather small and rounded head, without any marked constriction at the neck. Both the limbs and tail are short, the latter being cylindrical, slightly tapering, and somewhat trun-

cated at the end; while the disparity in the size of the fore and hind-feet is quite unknown in any of the Carnivores hitherto described. The skin is remarkably large and loose for the size of the animal, so that when removed from the body it can readily be stretched to a third more than its normal length. The pelage consists mainly of a fine soft woolly under-fur, among which are a small proportion of long stiff hairs. The general colour is dark liver-brown, silvered over with the greyish tips of the long hairs.

Remarkable as are the external characteristics of the sea-otter, it is not, however, solely, or even chiefly on them, that the zoologist relies in referring the animal to a genus apart from that containing the true otters. Equally noteworthy peculiarities occur in the number and structure of the teeth. In the first place, there are but two pairs of incisor teeth in the lower jaw,—a feature in which this species differs not only from other otters but likewise from every other true Carnivore. The total number of teeth is, therefore, thirty-two, as against thirty-six in the common otter; there being, as in the Indian clawless otter, but three pairs of premolar teeth in both the upper and the lower jaws. The cheek-teeth, although of the same general plan of structure as in the true otters, differ by their extremely blunted and rounded cusps. "If," remarks Dr. Coues, "the teeth of ordinary carnivorous quadrupeds be likened to fresh-chipped, sharp, and angular bits of rock, those of the sea-otter are comparable to water-worn pebbles"; and we know of no simile which can better express the difference between the cheek-teeth of the common and the sea-otter.

The sea-otter is an inhabitant of both coasts of the North **Habitat** Pacific; its chief haunts on the American side being Alaska, the Aleutian Islands, the neighbourhood of Sitka Island on the west coast of Canada, and Vancouver Island; its southern limits being the shores of Oregon. On the Asiatic side it occurs in Kamtschatka, but apparently more rarely than on the eastern shores of the Pacific.

It is stated by Mr. H. W. Elliot that when the Russian traders first opened up the Alcutian Islands, they found the natives commonly wearing cloaks made of the fur of the sea-otter, which they were at first willing to sell for a mere trifle, esteeming these skins much less than they did those of the fur-seals. Again, when the Prybiloff Islands, situated in Behring Sea to the eastward of the Aleutians, were first discovered, upwards of five thousand skins of this species were taken in the first season, while in six years these animals had completely disappeared from the islands. Nearly the same story is told in all the haunts of the sea-otter, which has now become a very rare animal indeed, and stands in sore need of protection if it is to escape total extermination. Mr. Elliot states that "over two-thirds of all the sea-otters taken in Alaska are secured in two small areas of water, little rocky islets and reefs around the islands of Saanach and Chernobours, which proves that these animals, in spite of the incessant hunting all the year round on this ground, seem to have some particular preference for it to the practical exclusion of nearly all the rest of the territory. This may be due to its better adaptation as a breeding-ground." A similar preference for a small area in the neighbourhood of Gray's Harbour over the whole of the remainder of the coast of Washington and Oregon is also exhibited by these animals.

It is not the mainland of Saanach Island which is frequented by the sea-otters, but the small islets and reefs lying to the southward and westward at a distance of about five miles, and thence stretching seawards, most of which are left bare at low water. Either on these islets and reefs, or, in calm weather, in the open sea around, the sea-otters are to be found.

The female sea-otter has only two teats, and produces but a

Breeding. single young one at a birth, so that the increase of the species can be, at the best, but slow. The young may apparently be born at any season of the year, and do not attain maturity till four or five years old. Writing of the general habits of the species, Mr. Elliot observes that the "mother sleeps in the water on her back, with her young clasped between her fore-paws. The pup cannot live without its mother, though frequent attempts have been made by the natives to raise them, as they often capture them alive, but, like some other species of wild animals, it seems to be so deeply imbued with fear of man that it invariably dies from self-imposed starvation."

The remarkable difference in the structure of the cheek-teeth of

Habits. the sea-otter from those of the true otters, clearly indicates that there must be an equally marked difference in the food of the two; and the rounded prominences on the crowns of those of the present species would further suggest that they were adapted for pounding and crushing hard substances. As a matter of fact, Mr. Elliot tells us that the food of the sea-otters "is almost entirely composed of clams, mussels, and sea-urchins, of which they are very fond, and which they break by striking the shells together, held in each fore-paw, sucking out the contents as they are fractured by these efforts; they also undoubtedly eat crabs, and the juicy tender fronds of kelp or sea-weed, and fish. They are not polygamous, and more than one individual is seldom seen at a time when out at sea. The flesh is very unpalatable, highly charged with a rank smell and flavour. They are playful, it would seem, for I am assured by several old hunters that they have watched the sea-otter for half an hour as it lay upon its back in the water and tossed a piece of sea-weed up in the air from paw to paw, apparently taking great delight in catching it before it could fall into the water. It will also play with its young for hours. The quick hearing and acute smell possessed by the sea-otter are not equalled by any other creatures in the territory. They will take alarm and leave from the effects of a small fire four or five miles to the windward of them; and the footstep of man must be washed by many tides before its trace ceases to alarm the animal, and drive it from landing."

In Alaska the sea-otter is often captured by shooting it in the

Hunting. head with a rifle-bullet when the animal is sporting in the surf; the booming of the surf deadening the report of the rifle, and thus allowing successive shots to be taken till one is successful. An older plan is, however, for a party to go out in canoes when a sea-otter has been observed, and by arranging themselves in a circle around its last point of disappearance, so harass the creature on its subsequent emergence that eventually it becomes exhausted from sheer inability to breathe. The third method is by knocking the animals on the head with heavy clubs; but this can only be done during the winter, at such times when strong gales are blowing from the northward. Then, writes Mr. Elliot, the boldest of the

natives set out in their canoes from Saanach, "and scud on the tail of the gale to the far outlying rocks, just sticking out above surf-wash, where they creep up from the leeward to the sea-otters found there at such times, with their heads stuck into the beds of kelp to avoid the wind. The noise of the gale is greater than that made by the stealthy movements of the hunters, who, armed each with a short, heavy wooden club, despatch the animals one after another without alarming the whole body, and in this way two Aleuts were known to have slain seventy-eight in less than an hour and a half." Instead of these methods, which are employed in Unalaska Island and the districts to the eastwards, among the Atka Aleuts the sea-otters are caught in small coarse-meshed nets. These nets are spread out over the kelp-beds upon which the otters are in the habit of sleeping. The animals, getting entangled in the meshes on their arrival, appear to become almost paralysed with fear, and thus fall an easy prey to the hunters.

On the other hand, in Kamschatka, according to Dr. Guillemand, the sea-otter is always shot with a bow and arrows. "The former is a tough piece of wood five or six feet in length, which is enormously strengthened by a band of plaited hide on the outer face, so tightly fixed as to give the bow a curve in the opposite direction when unstrung. The arrows are of wood for three-quarters of their length, with feathers fitted diagonally along the shaft, so as to produce a rotatory motion. The remaining portion is of walrus ivory, provided at the end with a socket, into which a barbed copper point is inserted. This is connected to the arrow by a long string of plaited sinew wound around the shaft. When the otter is hit, the barb, which is very loose, becomes at once detached, and if the animal gain the sea, its whereabouts is indicated by the arrow floating above it."

The skin of the sea-otter is perhaps the most valuable of all furs, **Pelage.** and when prepared for use has all the long hairs removed, leaving only the under-fur. In Kamschatka Dr. Guillemand states that a good skin will bring even as much as a hundred roubles to the native hunter, while a perfect example has been known to realise, according to Mr. Poland, as much as £200 in the European market. The average price in 1891 was £57 per skin.

CHAPTER XIX.

CARNIVORES,—concluded.

EARED SEALS, WALRUSES, AND SEALS.

Families *OTARIIDÆ*, *TRICHECHIDÆ*, and *PHOCIDÆ*.

THE whole of the Carnivores treated of in the preceding chapters constitute the more typical representatives of the order, and are hence collectively termed by zoologists true or fissiped Carnivores. In contrast to these is a much smaller group comprising the eared seals, the walruses, and the true seals, differing from the above by their flipper-like limbs, and hence known as the pinniped or fin-footed Carnivores. By some writers the pinnipeds are regarded as entitled to form an order by themselves, quite distinct from the Carnivores; but by the majority of naturalists, in England at least, they are considered to form merely a sub-order.

The members of the pinniped group have their entire organisation adapted for an aquatic life; this adaptation showing itself most markedly in the structure of their limbs. Thus both the fore and hind-limbs are modified into paddle or flipper-like organs, with nearly the whole of their upper portions, as far as the wrist and ankle, enclosed in the common integument of the body; while the feet themselves are greatly elongated—more especially in the hind-limb—and much expanded, with the whole of the five toes completely connected together by web. A peculiarity of the toes of the hind-foot is to be found in the circumstance that the first and the fifth toes, that is to say those corresponding respectively with the human great and little toes, are stouter, and in most cases also longer, than the three middle toes; an arrangement which is quite unknown among the true Carnivores, where the first toe is the shortest of the series. The pinnipeds are also characterised by the structure of their teeth, which are simpler than those of the true Carnivores, and never show a specially-modified “flesh-tooth” in one jaw biting against a somewhat similarly modified tooth in the opposite jaw. As a general rule, the cheek-teeth comprise four premolars and one molar on either side of each jaw; all these teeth being very similar to one another in general structure, and usually consisting of a pointed main cone, which may be flanked in front and behind by smaller cones, so as to produce a tricuspid tooth. Moreover, the number of incisor teeth is invariably reduced below the typical three pairs in each jaw; there being very frequently three pairs of these teeth in the upper, and two in the lower jaw, or but two pairs in each jaw. Then, again, all the pinnipeds are characterised by the reduced or rudimentary condition of their milk or baby series of teeth; these teeth being never of any real use to their owners, and being not unfrequently shed previous to birth. The foregoing characteristics are amply



A FAMILY PARTY OF SOUTHERN SEA-LIONS.

sufficient to distinguish the pinnipeds from the true Carnivores, although these animals also possess certain peculiarities in regard to their soft parts, into the consideration of which it is unnecessary to enter here. It may be mentioned, however, that all the members of the group have very short tails, while they are all remarkable for the large size and prominence of their eyes, this being probably necessary in order to secure accurate vision under water. It is also noteworthy that in all the members of the group the rudimentary collar-bones found in most of the true Carnivores have completely disappeared.

Those who admit the doctrine of the evolution of organic nature can have no hesitation in regarding the pinnipeds as a highly-specialised group, which has originated either from some section or sections of the true Carnivores, or from an extinct group, to be noticed later on. In the structure of their skulls the eared seals come nearest to the bears; and it is quite evident that the whole group must have descended from Carnivores which still retained the typical five digits on each foot. On the other hand, the true seals present some points of resemblance to the otters, and the sea-otter shows us how easily the transition from the ordinary otter type to the pinnipeds might have taken place. The sea-otter, however, is clearly (from the structure of its teeth) in no sense a "missing link"; and it is by no means improbable that the pinnipeds will be found to trace their origin directly to the extinct group of Carnivores to which allusion has been already made.

The pinnipeds are divided into three distinct families, namely, the eared seals, the walruses, and the true seals. Before proceeding to the consideration of these several families, we may refer, however, to a few characteristics common to the whole group. In the first place, the pinnipeds, as already mentioned, are thoroughly aquatic in their habits, resorting to the land only for the purpose of repose or breeding, and when there moving in an awkward and clumsy fashion. Moreover, they are, as a rule, marine; although some ascend tidal rivers, and a few are found in inland seas and lakes. In the latter instance there is, however, no reasonable doubt but that access to the ocean has been cut off since the date when the seals first reached the waters in which they are now confined.

In regard to their general characteristics, Mr. J. A. Allen, who has paid special attention to the American representatives of the group, observes that all the pinnipeds are distinguished by their high degree of intelligence, and are all capable of being easily domesticated, when placed under favourable conditions. They are, almost without exception, thoroughly carnivorous, "subsisting upon fishes, molluscs, and crustaceans, of which they consume enormous quantities. The walruses and eared seals are polygamous, and the males greatly exceed the females in size. The ordinary or earless seals are commonly supposed to be monogamous, and there is generally little difference in the size of the sexes. The walruses and eared seals usually resort in large numbers to certain favourite breeding-grounds, and, during the season of reproduction, leave the water, and pass a considerable period upon land. The earless seals, on the other hand, with the exception of the sea-elephants, do not so uniformly resort to particular breeding-grounds on land, and leave the water only for very short intervals."

Only one member of the whole group appears to be strictly tropical, and comparatively few even range into tropical regions; the great majority being

found in the Arctic, Antarctic, and Temperate zones, many of them being exclusively Arctic or Sub-Arctic, while one is as entirely Antarctic. And whereas the walruses are restricted mainly at the present day to the Northern regions, the other two families are well represented on both sides of the Equator. Most of the true or earless seals are confined to the colder latitudes, and generally produce their young on the ice.

THE EARED SEALS.

Family *OTARIIDÆ*.

Genus *Otaria*.

The eared seals form a well-marked family, which tends to connect the other and more specialised representatives of the group with ordinary terrestrial Carnivores. In the first place, their hind-limbs are decidedly less modified; all the eared seals, as is well shown in the illustration on p. 103, being characterised by having, when on land, the hind-flippers turned forwards under the body in the direction of the head, so that they aid in the support of the trunk in the ordinary manner. They derive their distinctive title from the presence of a small but well-defined external ear; and by these two characters an eared seal may always be distinguished at the first glance from all the other members of the group. They are further characterised by having the soles of both the fore and hind-feet entirely devoid of hair.

These animals also have well-marked necks, and their fore-feet are nearly as long as the hind ones. In the fore-feet the toes decrease in length from the first to the fifth, and have merely rudimentary claws; while in the hind-feet the three small middle toes generally have better developed claws, while the lateral pair are quite clawless. In both fore and hind-feet the skin extends considerably in advance of the tips of the toes, where it terminates in flaps. Usually there are thirty-four teeth, but sometimes, owing to the presence of a second pair of molars in the upper jaw, there may be thirty-six. There are always three pairs of incisor teeth in the upper, and two in the lower jaw.

The eared seals include the animals commonly known as sea-lions and sea-bears; and some of them furnish the "sealskin" of commerce. This sealskin is the under-fur, from which the long hairs of the outer coat have been removed; and such species as possess this under-fur are consequently termed fur-seals. Those species, on the other hand, which have only the ordinary close coat of hair, without any woolly under-fur, are commonly termed hair-seals; and their commercial value is limited to the oil and leather which they yield. In regard to the number of species of eared seals, and likewise as to whether they should all be included in a single genus (*Otaria*), or referred to two or more genera, there have been much discussion and difference of opinion. Writing in 1880 Mr. J. A. Allen put down the number of definable species as nine, of which five are hair-seals and four fur-seals. In the present work the whole of these will be included under the single generic title of *Otaria*; but an alternative plan is to restrict that name to

the Patagonian sea-lion, which differs in certain points from all the rest; and to refer the rest to a second genus (*Arctocephalus*).

This group is widely distributed over the temperate and colder regions of both the Northern and Southern Hemispheres; but, doubtless from the absence of suitable sites for breeding-places, is quite unrepresented in the North Atlantic. As a rule, sea-lions or hair-seals, and sea-bears or fur-seals, are found frequenting the same shores, but generally living apart from one another; while, with but rare exceptions, only one species of each section occurs in any one locality. Of the nine species provisionally recognised by Mr. Allen, two out of the five hair-seals are northern, and three are southern; while of the four fur-seals one is northern and three are southern. By later writers it is considered, however, that there are certainly two other species of southern eared seals.

Habits. As we have already had occasion to mention, the whole of the eared seals spend a good deal of their time on land, where they assemble in large companies; and they are also polygamous. Moreover, the males are generally much superior in size to their consorts. At the breeding-places, which are known among sealers by the very inappropriate name of "rookeries," the older males are always the first to arrive, and thereupon select particular stations for themselves, where they await the advent of the females. A continual warfare is maintained by the males among themselves for the preservation of these stations, and also for the defence of their females. The strongest males are naturally successful in obtaining possession of the largest number of females; the number of females on the stations of the largest males usually varying from ten to fifteen or more. To guard such large harems requires constant vigilance on the part of the males, who remain on land throughout the whole breeding-season, during which period they undergo an unbroken fast of several weeks' duration. When they first take up their stations on land, the males are fat and in good condition; but at the end of their sojourn they become emaciated and weak to the last degree. The females, although after their arrival they remain continuously for a certain period on the stations of their lords, do not spend nearly such a long unbroken period on shore.

Colour. The largest members of the family are hair-seals, and the smallest fur-seals. Mr. Allen states that "all the hair-seals are yellowish or reddish brown (in the Californian sea-lion sometimes brownish black), generally darkest when young, and becoming lighter with age, and also in the same individuals towards the moult season. . . . All the fur-seals are black when young, but they become lighter with age, through an abundant mixture of greyish hairs which vary from yellowish grey to whitish grey. The southern fur-seals are generally, when adult, much greyer than the northern." There is, however, much individual variation in colour among the members of a species according to age.

Pelage. The fur-seals are, of course, far more valuable commercially than the hair-seals. The best skins are afforded by young males and females; and these are prepared for use by the inner layer of the skin being shaved away with a sharp knife, thus causing the long hairs, which are deeper rooted than the woolly under-fur, to fall out.

Abundance. At the close of the last and during the early part of the present century fur-seals existed in countless numbers in many parts of the world; but human greed and folly have succeeded in so reducing their numbers in most regions that their pursuit is no longer profitable. Fortunately, however, both for science and for commerce, the seal rookeries of the Prybiloff Islands in Behring Sea have been placed under such restrictions as to render the annual slaughter compensated by the number of births. As an indication of the hosts of fur-seals formerly existing in various parts of the world, we may quote some figures given by Mr. Allen. Thus it is stated that in the year 1798 Captain Fanning, of the ship *Betsy* of New York, after obtaining a full cargo of skins from the island of Musapura, on the Chilian coast, estimated the number of fur-seals remaining on the island at from 500,000 to 700,000; and it appears that but little less than a million skins were subsequently taken from the same locality. Fur-seals were still found on the Chilian coast in 1815. From the Georgian Islands, at the extremity of South America, no less than 112,000 fur-seals are reported to have been taken in the year 1800, of which 57,000 were obtained by one American vessel. About this date the discovery of fur-seals in Australia was announced; and in 1804 a single ship obtained 74,000 skins. Large numbers were also taken about the same period on Prince Edward's Islands, lying a few hundred miles to the south-eastwards of the Cape of Good Hope. Again, between the years 1820 and 1821, more than 300,000 skins were taken from the South Shetland Islands alone; while it is estimated that at least 100,000 young seals were left to perish miserably, owing to the destruction of their mothers. In 1814 and 1815 the number of skins exported from Antipodes Island, off the coast of New South Wales, was upwards of 400,000, of which, it is said, no less than a fourth were spoilt owing to bad curing, and on arrival in Europe were sold as manure. As early, however, as the year 1830 the number of fur-seals in the southern seas had been so greatly diminished that vessels generally made losing voyages; and at the present day such a voyage partakes largely of the nature of a lottery. During the voyage of H.M.S. *Challenger*, the late Professor Moseley states that a considerable number of fur-seals were observed about Kerguelen Land; two schooners having obtained seventy in one day, and twenty in another. The number of skins taken in the Prybiloff Islands will be referred to later on; but it may be mentioned that at the present time, according to Mr. F. A. Lucas, the annual slaughter of fur-seals throughout the world averages 185,000, while that of hair-seals reaches the enormous number of 875,000.

THE SOUTHERN SEA-LION (*Otaria jubata*).

The southern or Patagonian sea-lion, of which a group is represented in the illustration on p. 103, is a hair-seal, and differs in certain respects both externally and internally from all the other species. It inhabits the Galapagos Islands, and the coasts of South America from Peru and Chili on the Pacific side, and from the Rio de la Plata on the Atlantic border, southwards to the Falkland Islands and Tierra del Fuego. Externally this species is distinguished from all the others by the long hair of the neck, which forms a kind of mane; although this mane is but



HOOKER'S SEA LION

indistinctly seen when the skin is wet. The profile of the head is nearly straight, the muzzle deep and somewhat truncated, and the naked portion of the nose large; while the upper lip has a number of thick bristles of considerable length, and hanging nearly straight down. The ears are also shorter in this species than in any other member of the group. There are likewise several features in the skull of this seal by means of which it can be distinguished from all the other eared seals; but it will suffice to mention here that the palate is deeply hollowed out and truncated behind, whereas in the other species it is neither hollowed out nor truncated behind. There are six upper cheek-teeth. The males of this species attain a length of about 7 feet from the tip of the muzzle to the root of the tail, although Captain Cook states that in his time much larger individuals were to be met with.

This species was one of the first members of the group known in

Habitat.

Europe, having been met with by Magellan as long ago as the year 1579, and long afterwards by Cook. It was likewise the first exhibited alive in England, a specimen having been bought by the London Zoological Society in 1866. Subsequently other examples were obtained from the Falkland Islands by a French sailor named Lecomte; and all who visited the Society's Gardens during 1868 and a few years later will have a vivid recollection of the docility and cleverness of these animals—to say nothing of their marvellous activity when in the water. Formerly these seals were extremely numerous in the Falkland Islands, and on the coasts of Patagonia and other parts of South America; but they are now comparatively few, and their distribution is restricted.

The following particulars of the habits of the sea-lion in the

Habits.

Falklands were communicated by Lecomte to Dr. J. Murie. At various times these seals were seen in parties of from six to twelve, and even as many as twenty; but fifteen may be taken as the average. Several such families may congregate in the same creek, to the number of from forty to a hundred; but the individuals of different families do not associate with one another. "They seem to prefer headlands or isthmuses, and choose the most southern locality thereon as a resting-place. One of the old males is on guard as a sentinel. Usually he is seen perched on an eminence, and invariably, as Lecomte affirms, with outstretched neck and upraised head, as if sniffing around for the slightest ominous warning. The signal of a grunt or growl sets the others on the alert; and on any real approach of danger they rush all helter-skelter towards the water, from which they never wander far. Their daily occupation seems divided between sleeping and procuring food. They lie huddled together in a drowsy condition, or slumber, for a great part of their time, and this both during the day and night. At high tides, night and day, they take to fishing near the entrance of the fresh-water rivulets into the sea. At such times they will remain a whole tide dabbling about singly after food. This consists of fish and crustaceans. In capturing their prey they swallow it either above or below the water. . . . Lecomte says these eared seals never drink water; and he substantiates the fact that he kept the first animal he brought to this country for a year without fluid, except such as adhered to the fish he fed it with. He tells me, moreover, he has noticed the common seals occasionally suck in water as a horse would, but the otaria never. Another curious

circumstance he assures me of is, that in the stomach of every one he has examined, with the single exception of a young animal, there existed a quantity of pebbles. The amount varied in individuals from a few to many."

Breeding. The females give birth to a single young one about the end of the year, equivalent to our midsummer. During the pairing season, which is in February and March, pitched battles occur between the males, during which the females look quietly on. At such times the males are savage; and if attacked will stand their ground. The old males generally utter a low kind of growl, but in the breeding-season this is prolonged into a loud, voluminous, interrupted roar. The young utter a kind of bleating cry. From July to November these seals migrate southwards from the Falklands. In colour the young are of a deep chocolate, but paler after the first year; the old males being of a rich brown tint, and the females greyer; while at all ages, and in both sexes, the flippers are of a darker hue than the body.

THE NORTHERN SEA-LION (*Otaria stelleri*).

The northern sea-lion, which is likewise a hair-seal, differs from the preceding species, and agrees with all those that follow by the absence of a mane on its neck, by its narrow and pointed nose, relatively long ears, and by the flattened palate of the skull, which is not truncated behind. In the concave facial profile it differs from the southern sea-lion.

This is the largest member of the whole group, full-grown males, according to Mr. Allen, measuring from 11 to 12 $\frac{1}{2}$ or 13 feet in total length, of which the tail forms 3 or 4 inches; while their girth varies from about 8 to 10 feet, and their weight is estimated at from 1000 to 1300 lbs. In colour the young are of a rich dark chestnut-brown. The adults, when they first reach the breeding-grounds, are of a light brownish rufous colour in both sexes, the tint being darker between the fore-limbs and on the under-parts. Later on in the season the colour changes, however, to a golden rufous or ochrey tint; and when the new winter coat appears in November, the colour has been described as a light sepia, or Vandyke brown, with deeper tints on the under-parts; and at this season of the year the females are distinctly of a lighter colour than the males.

Distribution. This fine seal inhabits the shores of the North Pacific from Behring Strait southwards to California and Japan, and is one of the species found in the Prybiloff Islands in Behring Sea; its northern limits being apparently determined by the southern border of the Polar floating ice. It was first discovered in the year 1741, during Behring's first expedition, and was described by the naturalist Steller, who accompanied that navigator.

Habits. Mr. W. D. Elliot, writing of this species in the Prybiloff Islands, observes that it has a really leonine appearance and bearing, greatly enhanced by the rich golden-rufous of its coat, and the ferocity of its expression. Although provided with flippers, to all external view the same as in the fur-seal, it cannot, however, make use of them in the same free manner. While the fur-seal can be driven five or six miles in twenty-four hours, the sea-lion can barely go two, the conditions of weather and roadway being the same. The sea-lions balance and

swing their long heavy necks to and fro, with every elevation of their hind-quarters, which they seldom raise from the ground, drawing them up after the fore-feet with a slide over the grass, sand, rock, etc., as the case may be; and pausing frequently to take a sullen and ferocious survey of the field and the drivers. It further appears from the same account that the males are less systematic and exacting in the formation and protection of their parties of females than is the case with the northern sea-bear; and they are not known to travel so far inland. Moreover, these seals are very shy and wary, and never allow their haunts to be



THE NORTHERN SEA-LION ($\frac{1}{10}$ nat. size).

visited by man without making a sudden rush to the sea. The males leave the sea and take up their stations on the narrow belts of ground, which they prefer, early in May, while the females follow them after an interval of three or four weeks, thus arriving during the first weeks in June. Usually each male during the breeding-season is accompanied by from ten to fifteen females. The latter are allowed to move freely from place to place; and are accustomed to go down to the shore, accompanied by their young—often carried by the nape of the neck—and disport themselves in the surf; such rambles being never undertaken by the female sea-bears. On the two main islands of the Prybiloff group, respectively known as St. Paul's and St. George's, it was estimated by Mr. Elliot that

not more than 25,000 of these seals were in the habit of visiting the former; while from 7000 to 8000 landed on the latter. The voice of this species is described as a deep, grand roar, forming a low muttering growl.

Another observer, Captain Charles Bryant, gave the following account of the habits of these seals to Mr. Allen:—"From 15,000 to 20,000 sea-lions breed annually on the Prybiloff or Fur-Seal Islands. They do not leave the islands in winter, as do the fur-seals, to return in spring; but remain during the whole year. They bring forth their young a month earlier than the fur-seal, landing during the months of May and June. They advance but little above high tide-mark; and those of all ages land together. The strongest males drive out the weaker, and monopolise the females, and continue with them till September. They go with them into the water whenever they are disturbed; and also watch over the young. When in the water, they swim about the young, and keep them together until they have an opportunity to land again. The females also keep near, rushing hither and thither, appearing first on one side and then on the other of the groups of young, constantly uttering a deep, hoarse growl at the intruder whenever they come to the surface. When left undisturbed they all soon land again, preferring to spend the greater portion of their time at this season on the shore. During the breeding-season they visit the same parts of the shore as the fur-seals; but the sea-lions, by their superior power and strength, crowd out the fur-seals—the latter passively yielding their places without presuming to offer battle to their formidable visitors. After having been disturbed, the sea-lions continue for some time in a state of unrest, occasionally uttering a low moaning sound, as though greatly distressed. Even after the breeding-season they keep close to the shore near the breeding-station until the severe weather of January. After this, they are seen only in small groups till the islands are free from ice and snow in the spring."

The sea-lions on St. Paul's Island are driven a distance of from **Capture.** ten to twelve miles along the shore to the village where they are to be killed; and from their slow rate of motion, to which allusion has already been made, the journey is a long and protracted business, usually taking about five days. When once fairly started, and accustomed to the presence of man, the animals are, however, readily controlled, and kept in the desired direction. At the end of a day's journey they are allowed to refresh themselves by plunging in the pools found in many parts of the route. When thoroughly tired out at the end of a day's march, the unfortunate animals stretch themselves at full length on the ground, with extended limbs. Even then, however, writes Captain Bryant, "their rest is not peaceful, for some restless one soon starts up and flounders over the others, as if seeking a better place. This disturbs the whole herd, which constantly keeps up a low moaning, apparently expressive of sore distress." "By this time," the author continues, the sea-lions have "become so accustomed to their captors that they will sooner fight than run from them; and they are too much deafened by their own noise to hear or fear any other sound. As they lie on the ground in a compact mass, one of the men takes an umbrella, and goes twenty to thirty yards to the rear of the herds, and approaching stealthily until he is quite near, suddenly expands the umbrella, and runs with it all along the edge of the herd; then, closing

it, he retires to repeat the manœuvre. This has the effect of rousing the rear rank, which, thus suddenly alarmed, plunges forward and arouses those in front, which suddenly begin struggling and biting. The return of the man with the umbrella communicates another shock, and adds another wave to the sluggish mass. This is repeated at intervals of four or five minutes, till the successive shocks have aroused the whole herd, when, with much roaring and bellowing, the whole mass begins to move, gradually extending itself in a long irregular line in open order, each animal lumbering along as best it can. By shouting and waving flags at the rear, and on the flanks of the herd, they are kept moving until it is necessary to halt them again for rest."

Finally, the herd reaches the village, when the sea-lions, being far too formidable animals to be despatched with clubs, are shot with rifles; the full-grown males being killed first, after which the fore-part of the herd is driven back upon and over the rear, when the slaughter is continued with lances. The description of this scene is, however, by no means pleasant reading, and may accordingly be passed over.

Californian Sea-Lion. The Californian sea-lion (*O. gillespii*), which, far from being restricted to the country from which it derives its name, is found on both sides of the North Pacific, is a much smaller species than the last, from which it is readily distinguished by the convex crown of the head, and the sudden descent of the profile at the eye; the side view of the head somewhat recalling that of the dog-faced baboons. The bristles on the side of the muzzle are also very small. The skull is characterised by its narrowness and elongation, and also by the great development of the bony crests on the brain-case. The general colour is a dark chestnut-brown, becoming blackish brown on the under-parts and limbs; but there is great seasonal and individual variation in this respect. Mr. Allen gives the total length of adult males as varying from 7 to 8 feet; those measurements being taken from the muzzle to the end of the outstretched flippers.

Habits. There has been some confusion as regards the habits of this species, owing to its having been confounded with the northern sea-lion. Both species occur on the Farallone Islands, near San Francisco; but the present species is by far the more numerous of the two, and appears to be the only one represented on the neighbouring island of Santa Barbara. Mr. Elliot states that the two species may be readily distinguished by their voices; the northern



HEAD OF CALIFORNIAN SEA-LION.—After Forbes.

sea-lion uttering only a deep, bass growl, and a prolonged, steady roar; whereas the Californian sea-lion never roars, but utters a sharp bark, sometimes almost approaching a howl.

The general habits of this species seem to be very similar to those of the northern sea-lion. On the Farallones these seals are found in vast numbers, and their barking is described as forming an incessant din. Captain Scammon, writing of his experiences with these animals on the island of Santa Barbara, during the sealing season of 1852, states that soon after the arrival of his party, about the end of May, the colonies of Californian sea-lions "began to augment, and large numbers of huge males made their appearance, belching forth sharp, ugly howls, and leaping out of or darting through the water with surprising velocity, frequently diving outside the rollers, the next moment emerging from the crest of the foaming breakers and waddling up the beach with head erect, or, with seeming effort, climbing some kelp-fringed rock to doze in the scorching sunbeams; while others would lie sleeping or playing among the beds of sea-weed, with their heads and outstretched limbs above the surface. But a few days elapsed before a general contention with the adult males began for the mastery of the different rookeries; and the victims of the bloody encounter were to be seen on all sides of the island, with torn lips or mutilated limbs and gashed sides, while now and then an unfortunate creature would be met with minus an eye, or with the orb forced from its socket, and, together with other wounds, presenting a ghastly appearance. As the time for 'hauling up' drew near, the island became one mass of animation; every beach, rock, and cliff, where a seal could find foothold, became its resting-place, while a countless herd of old males capped the summit, and the united clamourings of the vast assemblage could be heard on a calm day for miles at sea. The south side of the island is high and precipitous, with a projecting ledge, hardly perceptible from the beach below, upon which one immense sea-lion managed to climb, and there remained for several weeks."

The same observer adds that "at the close of the season—which lasts about three months on the Californian coast—a large majority of the great herds, both males and females, return to the sea, and roam in all directions in quest of food, as but few of them could find sustenance about the waters contiguous to the islands, or points on the mainland, which are their annual resorting places. They live upon fish, molluscs, and sea-fowls, always with the addition of a few pebbles or smooth stones, some of which are a pound in weight." The quantity of fish consumed by these seals must, indeed, be enormous. Some years ago it was estimated that the total number of sea-lions in the neighbourhood of San Francisco was upwards of twenty-five thousand, each of which consumed from 10 to 40 lbs. weight of fish per diem. In capturing gulls the Californian sea-lions display no little skill and cunning. When in pursuit of a gull Captain Scammon states that the seal dives deeply under water, and swims some distance from where it disappeared, then, rising cautiously, it exposes the tip of its nose above the surface, at the same time giving it a rotary motion, like that of a water-buoy at play. The unwary bird on the wing, seeing the object near by, alights to catch it, while the sea-lion at the same moment settles beneath the waves, and at one bound, with extended jaws, seizes its screaming prey, and instantly devours it.

The Californian sea-lion is the species most commonly seen in captivity in Europe, as it appears to thrive better than any other of the eared seals in that state.

In captivity these sea-lions display great affection for one another; and when one of a pair dies the survivor not unfrequently pines away and dies soon after. From observations made on captive specimens in Chicago, it appears that before the cub takes to the water the parent secretes a kind of oily fluid from her body, with which the hair of the cub becomes anointed, owing to both animals rolling on the same spot.

Hooker's Sea-Lion. With this sea-lion (*O. hookeri*), we come to a southern species of hair-seal, first obtained from the Auckland Islands, lying to the south of New Zealand, during the voyage of the *Erebus* and *Terror*. This species, of which examples have of late years been exhibited alive in the London Zoological Society's Gardens, is subject to great variation in colour, some specimens being greyish, while others have a more or less markedly brown tinge. The head is readily distinguished from that of the preceding species by its nearly straight profile; the muzzle is of considerable length, the ear of medium size, and the bristles on the muzzle well developed. The skull is characterised by the extreme narrowness of the palate, and has seven upper cheek-teeth—in the latter respect agreeing with that of the southern sea-lion.

Australian Hair-Sea Seal. The hair-seal (*O. lobata*), inhabiting the seas of Australia, appears to form a kind of connecting link between the hair and the fur-seals, the cubs having a thick coat of soft under-fur, which quite disappears in the adult. This indicates that the distinction between hair and fur-seals is of no great zoological importance, although it forms a convenient mode of classifying the members of this difficult group. The profile of the head is nearly straight, and the whole head large and massive, with rather small ears. The males are considerably darker than the females, and the cubs are black. From the presence of a stripe of rich deep fawn colour (which is lighter than the general tint of the body) running across the hinder part of the head, nape, and sides of the neck, the name of cowled seal has been applied to this species. The general length of old males is from 8 to 9 feet, but few such specimens are stated now to exist. These seals were found abundantly in King George's Sound, and also in Bass Strait. The Seal Rocks off Port Stephens, to the northward of Sydney, partly derive their name from the presence of colonies of this species.

THE NORTHERN SEA-BEAR (*Otaria ursina*).

The well-known northern sea-bear, or northern fur-seal, is the first representatives of the true fur-seals, and the only one found in the Northern Hemisphere. In this, as in the other fur-seals, the pelage is soft, with an abundant under-fur; and the colour of the adult is some shade of dark grey, while the young are black. There are six cheek-teeth in the upper jaw.

The northern sea-bear, as shown in the accompanying illustration, is distinguished at a glance from all the southern fur-seals by its extremely short face, in which the profile is nearly straight, and likewise by its relatively weak

dentition. In the adult males the general colour of the upper-parts, with the exception of the shoulders, is nearly black, with a more or less marked grey, or reddish grey grizzlo; but the shoulders are distinctly grey. The sides of the nose and lips are brownish, the breast is brownish orange, while the limbs and under-parts are reddish brown. The females are much lighter in colour, being uniformly grey above, with the under-parts brownish or rufous. In both sexes the individual variations in colour are largely due to the varying proportions of the grey in the



THE NORTHERN SEA-BEAR ($\frac{1}{2}$ nat. size).

hairs. The young when first born are of a uniform glossy black colour, with the under-fur lighter in hue, and less abundant than in the adults.

These seals are much smaller than the larger sea-lions, the old males, according to Captain Bryant, measuring from 7 to 8 feet in total length, and having a girth of from 6 to 7 feet; while their weight is estimated at from 700 to 800 lbs. They do not attain their full size till about the sixth year. The females, which reach their full dimensions when five years old, measure 4 feet in length and $2\frac{1}{2}$ feet in girth, and weigh from 80 to 100 lbs. The ears are absolutely longer than in the far larger northern sea-lion. The difference in the dimensions of the two sexes is greater than in any other member of the family.

Distribution. The northern sea-bear inhabits both shores of the Northern Pacific, and is known to have been formerly abundant on the American side as far south as California, although the precise limits to which it once ranged in this direction have not been ascertained. On the Asiatic side of the Pacific its range embraced Kamschatka and the Kurile Islands, and extended as far as the southern extremity of Saghalien Island, where it was still abundant at the period of the Crimean war.

At the present day, as is well known, the headquarters of the sea-bear are the Prybiloff Group, which comprises four islands, respectively known as St. Paul's, St. George's, Otter, and Walrus Islands; the two former of which are alone visited by the seals. Here the capture of the seals is strictly regulated, only a certain number being allowed to be captured annually. The Alaska Commercial Company leased from the United States Government in 1869 the sole right of sealing on these islands; the lease permitting them to capture 25,000 seals on St. George's and 75,000 on St. Paul's. And it appears that in the twenty years, from 1869 to 1889, the company has realised upwards of thirty-three millions of dollars by the sale of seal-skins. Of recent years large numbers of British vessels fitted out from Victoria and British Columbia have, however, been in the habit of visiting Behring Sea for the purpose of taking seals; and it is stated that in consequence of this the profits of the Alaska Company have considerably diminished. In the recent dispute between the British and United States Governments regarding this sealing in Behring Sea the United States declared that the sea in question was a *mare clausum*, a claim which the British Government successfully resisted.

Besides St. George's and St. Paul's, no other islands in Behring Sea appear to form suitable habitats for the sea-bears, which require a low, shelving coast, either of smooth rocky ledges or of shingle, with a cold climate and a fog-laden atmosphere. If the ground is such that water can collect in puddles, the seals avoid it, and if the coast is sandy the wind blows the sand into their large, sensitive eyes, causing them intolerable discomfort. The number of sea-bears on these two islands during the breeding-season is so enormous as to defy anything like exact calculation. In the summer of 1872 Mr. Elliot estimated, however, that there were upwards of 3,000,000 on St. Paul's, while in the following year he put down the number on St. George's at about 163,000.

Habits. It is mainly to Mr. Elliot that we are indebted for a full and adequate account of the habits of the sea-bears on the Prybiloffs, and it is from his graphic descriptions that the following summary is derived.

During the winter the Prybiloffs are deserted by these animals, which follow the southward migration of the fish upon which they chiefly subsist. The old males are the first to revisit their old haunts in the following spring; and a few of these may generally be found on the islands during the first week in May. At this time the males are very shy and sensitive, and remain near the shore; indeed, many of them will sometimes spend several days in swimming round the rocks before venturing to land. The first arrivals are not always the oldest, but rather the finest specimens of their race; and are always fully capable of maintaining possession of the stations they select immediately after coming ashore. As a rule, it appears that the males do not reoccupy the same stations year after year, although

sometimes a few may do this for a few seasons. "From the time of the first arrival in May, up to the first of June, or as late as the middle of the month," writes Mr. Elliot, "if the weather be clear, is an interval in which everything seems quiet; very few seals are added to the pioneers. By the first of June, however, or thereabouts, the foggy humid weather of summer sets in, and with it the bull-seals come up by hundreds and thousands, and locate themselves in advantageous positions for the reception of the females, which are generally three weeks or a month later." Then comes the great struggle for obtaining and maintaining a position on the land, those males which are the last to arrive, and also those occupying the posts nearest the water's edge, having the greatest difficulties to overcome. Frequently the combats which then take place result in death; while some of the earlier arrivals which have taken up stations near the shore become exhausted by repeated struggles, and have to shift to more inland quarters. "The fighting," says Mr. Elliot, "is mostly or entirely done with the mouth, the opponents seizing each other with the teeth, and clenching the jaws. Nothing but sheer strength can shake them loose and that effect almost always leaves an ugly wound, the sharp canines tearing out deep gutters in the skin and blubber, or shredding the flippers into ribbon-strips."

During the time that the males are thus engaged in selecting and maintaining their positions, they may be approached from the leeward when asleep so closely as to admit of the bristles on their muzzles being pulled. The adventurous investigator is, however, warned that after one such experiment he must beat a hasty retreat, if he would escape an unpleasant mauling from the animal's teeth.

At this period the males give vent to four distinct cries, namely, a hoarse, resonant, long, and loud roar; a low, gurgling growl; a kind of hissing, chuckling, piping whistle, which must be heard to be recognised; and a kind of spitting sound and action, which is the most characteristic of all. The females, on the other hand, have only a kind of bleating cry, used merely to attract the attention of the cubs; while the call of the latter is still more sheep-like. Indeed, it is stated that some sheep imported into St. George's were constantly misled by the cries of the females and young seals into believing that others of their own species were in the neighbourhood. The seals when on land are extremely impatient of heat, a temperature of 48° being unpleasant to them; while when the thermometer ranges from 55° to 60° they appear to suffer great inconvenience. On such occasions they may be seen lying in every conceivable position, industriously fanning themselves with their flippers, sometimes holding the fore-flippers vertically upwards as a kind of ventilator, while one or both of the hinder pair are employed as fans.

From their first arrival until the end of the pairing season, which terminates during the first third of August, all the males which succeed in maintaining their posts never leave them for a single instant; and consequently never partake of either food or water for at least three months, while in some instances this fast endures for upwards of four months. During this time they must subsist entirely on their own fat; and it will not fail of notice that such a fast is very different from that endured by bears and other hibernating animals, during which most of the functions of the body are dormant. Nevertheless, no ill consequences appear to accrue, since the old male sea-bears come back year after year as fat and sleek as ever.

Between the 12th and 14th of June the first females make their appearance on the Prybiloffs. When they first land, wet and dripping from the sea, they are of a dirty grey colour, darker on the head and back than elsewhere; but when thoroughly dried their coat is of a steel-grey above, and nearly white beneath, with a brilliant gloss. A few days' exposure to the weather is, however, sufficient to tone down this brilliant dress to a sombre greyish brown above, and an ochre tint below. Immediately on their arrival, the females are received with most marked attention by the males nearest the shore, but they are seldom allowed to rest long with these, as the males on the more inland stations are ever on the watch to seize and take possession of them during the time that their temporary masters are on the look-out for fresh wives. In this manner the unhappy females may be seized by the scruff of their necks as unceremoniously as a cat takes its kitten, and passed on from male to male, until they reach a place of security in the stations farthest away from the water. During all this time fierce contests are continually taking place among the males. By the time of the arrival of the last batches of females, which takes place usually between the 10th and 15th of July, the males have become thoroughly exhausted, and have obtained as many females as they desire. Consequently, the females are now allowed to crowd in through the fifteen or sixteen rows of stations usually intervening between the shore till they reach the open ground in the rear of the colony, where they congregate in droves, carefully selecting places where there are no pools of water.

It is considered by Mr. Elliot that, on the average, each male in the neighbourhood of the shore has from twelve to fifteen females, while those more inland have only from five to nine. One old male was observed with upwards of forty-five females under his charge, but this individual was favoured by his situation, which had but one path of access. A certain number of males in the rear of the colony never obtain partners at all; though towards the close of the season some of them may step into the places of those of their sex as have to leave their stations through exhaustion. The males display extreme courage in defending and maintaining their positions; and will even stand being fired at with shot without forsaking their posts. The females, on the other hand, are remarkable for their gentle disposition, never quarrelling among themselves, and but seldom uttering a cry when roughly handled and severely wounded by the contending males. During their sleep the bodies of all the sea-bears are continually undergoing various quivering and rolling motions, accompanied by twitchings of the paddles.

The cubs are born shortly after the landing of the females, coming into the world with their eyes open, and soon finding their voice, and taking to the water. It is but rarely that there is more than a single cub at a birth. They weigh from 3 to 4 lbs., and vary from 12 to 14 inches in length when born; their jet-black coat being retained for three months. Both parents seem to treat their offspring with marked indifference; and a cub which has strayed a short distance from the station of the father may be killed before the eyes of the mother without evoking any concern on her part. Although the males will often rush right into the middle of a whole party of cubs, it is but seldom that any of the latter are killed.

After the birth of their offspring, the females appear to make frequent visits to the sea, usually returning close to the spot where their cubs were left, and

singling out their own offspring by its cries without a moment's hesitation. The cubs are accustomed at an early period to collect in large numbers, while from the latter part of September to the time of departure in November, they assemble together in tens of thousands. Even among such numbers, the female instantly recognises the voice of her own offspring, and promptly makes her way by thrusting right and left to that spot in the assembly where it may happen to be. It is said that the cubs themselves do not know their own mothers, but as they incessantly utter their cry at short intervals, the females have no difficulty when returning from the sea in finding their offspring.

Between the end of July and the close of the first week in August, the seal colonies have entirely altered in appearance, owing to the breaking up of the various family parties. The old males leave their stations, and betake themselves to the sea, in a very emaciated condition; the majority of them not returning to the land. Such, however, as do make a second visit are in fine condition, and have grown a new and brilliant coat of fur. The return visit does not take place till the end of September; and the males then prefer to congregate on the beach, instead of going up to their old ground. After the departure of the old males in the beginning of August, the females, cubs, and those males which did not succeed in obtaining wives, take possession of the entire seal area in a very disorderly manner; while their numbers are augmented by the landing of a host of young males which had hitherto been prevented by their elder brethren from obtaining a footing on shore. At this time three-fourths of the females are generally in the water, only coming ashore for short intervals to look after their cubs. They lie idly in the waves, now and again lazily rolling over, and continually scratching their sides and backs with their flippers. After the first week in August the cubs nearest the shore make their first attempts at swimming, but are extremely awkward, and quickly tire with their efforts. Soon, however, they become adepts in the art, and may then be seen sporting and frolicking in the water with the greatest apparent enjoyment. By the middle of September all the cubs have become thoroughly familiar with the water, and have entirely deserted the higher grounds to take up a position on the rocks and beaches near the water's edge, previously unoccupied by any of the seals. Finally, in November the islands are deserted by the great mass of the sea-bears, although some do not leave for their southerly migration until driven off by the snow and ice, as late as the end of December or the 12th of January.

The preceding observations relate almost exclusively to the old males, the females, and the cubs; but a few words are necessary as to the young males under six years of age, which are known to the sealers as "bachelors." In the early part of the season these come out of the sea in detachments of from a hundred to a thousand strong, but later on by hundreds of thousands. They generally go to a distance of from a quarter to half a mile from the shore, on what are technically known as the "hauling-grounds," in contradistinction to the "rookeries." These seals are in some cases allowed to pass up and down to their haunts by passages left between the family parties on the rookeries; but more generally repair to the beaches unoccupied by the rookeries, where they will occupy the whole space from the shore to a distance of a quarter of a mile or more inland. Some of the younger

ones will, moreover, occasionally desert the neighbourhood of the shore, and proceed still further inland to play among the fresh moss and grass which grows in the interior. These young seals do not undergo any long periods of fasting, but are constantly repairing to the sea at short but uncertain intervals. For instance, during a few dull and foggy days they may be found by hundreds of thousands on the hauling-grounds; but a single warm and sunny day will drive almost the whole assemblage to the sea, leaving their haunts well-nigh deserted. They are thoroughly restless creatures, being constantly on the move; and although very frolicsome and sportive, never seen to quarrel or fight. In the water these young seals distinguish themselves by their active evolutions; frequently jumping out after the manner of dolphins, more especially when surprised, and in such cases turning their heads when in the air to catch a glimpse at the cause of their disturbance.

Mr. Elliot adds that sea-bears of all ages "swim with great rapidity, and may be fairly said to dart along with the velocity of a bird on the wing under the surface of the water; and in all their swimming I have not been able yet to satisfy myself how they used their long, flexible hind-feet, other than as steering mediums. The propelling motion, if they have any, is so rapid, that my eye is not quick enough to catch it; the fore-feet, however, can be very distinctly seen to work, feathering forwards and sweeping back flatly, opposed to the water, with great rapidity and energy, and are evidently the sole propelling power."

It appears that of the total number of sea-bears about half are

Capture.

males and half females; but some two-thirds of the former are never permitted by their older and stronger brethren to mix with the females, but herd together by themselves in the manner just described. It is these bachelor seals which are alone allowed to be killed in the Prybiloffs; and it will be evident that their association by themselves—frequently miles away from the breeding-grounds—must greatly facilitate the arrangements for their slaughter. When the bachelor seals are assembled near the water, on some morning early in June, a small party of natives will run along the beach, and readily turn thousands of them inland. When once turned, the party is easy to manage; and on firm or grassy ground the whole herd in cool weather can be driven at the rate of half a mile an hour, but frequent halts must be made. The weaker seals will, however, drop out from time to time, and are left either to recover or to perish, especially when the march is long; it is therefore advisable to make the journey as short as possible.

Arrived at the place of slaughter, the seals are herded, and allowed to rest and cool; after which they are driven off in detachments of from fifty to two hundred, and knocked on the head with heavy oaken bludgeons. The work of killing and skinning is carried out with great rapidity; a party of forty-five men having driven, killed, and skinned upwards of seventy-two thousand sea-bears in less than four weeks during the summer of 1872.

It has been already mentioned that the number of the sea-bears allowed to be killed annually on the Prybiloffs is limited by the terms of the lease to 100,000. There is, however, reason to believe that considerably more than this number are killed by the natives; and it is further asserted that the total number of sea-bears visiting the islands is steadily diminishing.

In addition to the seals killed on the Prybiloffs, a large number have of recent

years been taken in open water by British vessels cruising in Behring Sea; and it was, as already said, in regard to these that the international dispute referred to above arose. The seals thus taken appear to be exclusively young males or barren females, which have remained at sea during the months of May and June, when the great body has gone northwards to the Prybiloffs. Well-appointed schooners are engaged in this trade, and the method of procedure is thus described by a correspondent of the *Times*. When one of these vessels is at sea, "and seal are sighted, the little boats are hoisted out; a hunter, armed with two shot guns and a rifle, and two sailors to pull the boat, take their places, and the hunt begins. A seal swimming on the water, or perchance sleeping, is sighted, and the boat is pulled quietly toward the animal. In nine cases out of ten, the seal takes alarm and dives out of sight before the boat is brought close enough to use the guns with effect, and in no case does the hunter shoot unless he feels sure of his quarry. The seal, when shot, at once commences to sink, and the boat has to be pulled rapidly up to it, when the carcase is 'gaffed' and hauled aboard. This is repeated as long as a seal can be seen. In many instances only one or two will be killed during a whole day's hunting, but at other times as many as twenty will be taken. After a day's hunt the boats return to the schooner, and the seals are skinned and the pelts laid in salt in the hold. This goes on from day to day during the season. The seal has a chance of escaping, and the percentage killed is very small. When it is considered that an extent of ocean of nearly twelve thousand square miles is hunted over, the chance is slight of the seals being exterminated by the fleet of fifty or so vessels engaged in the seal-hunting business. It has been asserted that only a few seals out of every hundred shot are captured by the hunters; that the balance sink or escape wounded, to die later on. This is not so. On the contrary, a seal hardly ever escapes when shot. Of course a few do, but the percentage is small, probably not over five or six out of the hundred." Although it has been asserted that the number of sea-bears in the open sea is annually diminishing, this is denied by unprejudiced experts; and it is mentioned by the writer last cited that "the oldest hands in the business state that there are apparently as many seals in the sea nowadays as there were many years ago. There is, however, some greater difficulty experienced in capturing them. The older ones have learned what a sealing boat is, and at the sound of a gun, or at the approach of a boat, the wary animal is on its guard, and thus it is harder for the hunter to get within range of his quarry. Yet, in spite of this fact, large numbers are killed, and the business is fairly profitable." Of the two methods of sealing, the shooting in the open sea is decidedly to be preferred on humanitarian grounds, more especially if it be true, as asserted, that on the Prybiloffs a considerable number of breeding female seals are killed before their cubs are old enough to shift for themselves.

THE SOUTHERN FUR-SEALS.

In the Southern Hemisphere there are some four species of sea-bears or fur-seals, all of which differ from the Northern sea-bear in their much longer, narrower, and more depressed muzzles, and also in the circumstance that the flaps

of skin projecting in advance of the toes of the hind-flippers are much less elongated. The Southern fur-seals are also, as a rule, decidedly greyer in colour than their northern cousin. There is still some uncertainty as to the number of species belonging to this group, and their resemblance to one another is so close that it requires an expert to distinguish between them.

South American The South American, or Falkland Island fur-seal (*O. australis*)

Fur-Seals. inhabits the Galapagos Islands, and the shores and islands of South America southwards from Chili on the western, and from the Rio de la Plata on the eastern side; being more numerous on the Falkland and South Shetland Islands than on the continent itself. The males attain a length of from 6 to 7 feet, while the females average about 5 feet; the disproportion between the sexes being thus much less than in the northern sea-bear. The colour of the fur is distinctly grey.

Habits. The habits of this species seem to be very similar to those of its

northern cousin; the old males arriving on the Falklands before the females, and similar contests taking place for the possession of the latter, which arrive in December. The cubs are born during the same month, and are able to swim well by February. The young males remain at sea during the greater part of the summer, not landing till February or March. They sojourn on land till the latter part of April, when they again take to the water; but towards the end of June they once more visit the shore for several weeks, remaining partly on land and partly in the sea. When Weddell visited the South Shetlands during his voyage, lasting from 1818 to 1821, these seals were very numerous, and had so little fear of man that numbers of them were killed and skinned without disturbing the remainder of the party. Moseley, during the voyage of the *Challenger*, found, as already mentioned, these seals still fairly numerous on Kerguelen's Land, although, from the reckless way in which they were slaughtered, they appeared in imminent danger of total extermination. Like the sea-lions of the same regions, the southern fur-seals prey at times upon penguins.

The Cape fur-seal (*O. pusilla*) is a very well-marked species,

Cape Fur-Seal. characterised by the straight profile of the head, the overhanging and sharply-pointed muzzle, the relatively long ears, and the extreme length of the numerous bristles depending from the upper lip. A living example, formerly exhibited in the London Zoological Society's Gardens, had a whitish red fur grizzled with blackish hairs, while the under-parts were of a reddish brown colour. This seal appears to be confined to South Africa, inhabiting the small islands round the Cape of Good Hope, as well as others some forty miles distant from Port Elizabeth. It probably also once inhabited Tristan da Cunha. It is still fairly common, but its fur is of comparatively little value, owing to the shortness of the hair, although that of the young animals is longer. Some years ago, from 70,000 to 80,000 skins were annually imported from the Cape into London, but the number is now much reduced. In Algoa Bay as many as from 200 to 300 of these seals have been taken during a single night.

New Zealand There has been much uncertainty with regard to the fur-seals

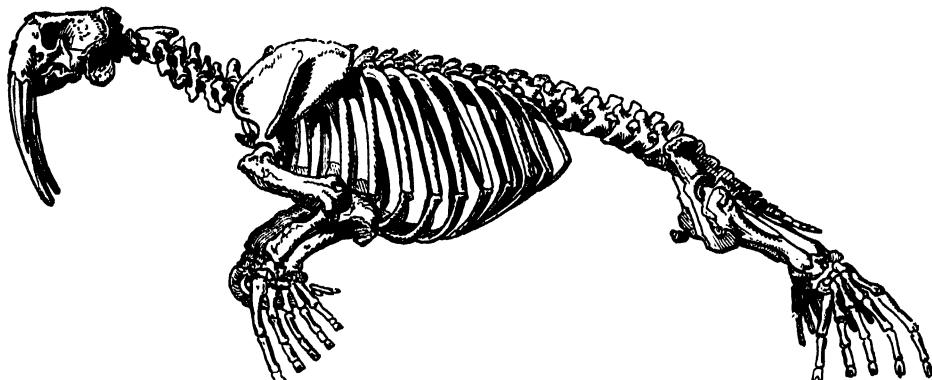
Fur-Seal of the Australian seas, but it now appears that there is but one species, namely, the New Zealand fur-seal (*O. forsteri*), of which the so-called cinereous fur-seal (*O. cinerea*), according to Mr. H. O. Forbes, is the female. This

seal is the only one found on the New Zealand coasts, and it also occurs at Chatham Island and the Seal Rocks near Port Stephens. Although formerly abundant, it is now becoming very rare. At the time of Flinders' visit in 1798 it was found in thousands at Passage Point, to the north of Tasmania. The males are usually dark grey above and brown below, while the lighter females are generally yellowish brown above and dark below, some of them having a crest of long whitish hairs. While the fur of the male is valuable and beautifully curled, that of the female seems to have frequently but little under-fur, so that skins have been described as those of hair-seals.

THE WALRUS.

Family *TRICHECHIDÆ*.

The huge and ungainly animals, commonly known by the name of walrus (from the Scandinavian *valross*, meaning whale-horse), constitute not only a distinct genus of the Pinniped Carnivores, but are likewise the sole representatives



SKELETON OF THE WALRUS.

of a special family. Walruses are strictly confined at the present day to the Arctic regions of both hemispheres; but there is some difference of opinion as to whether those found in the Pacific are specifically distinct from the typical Atlantic form. The two are, however, so extremely closely allied that we prefer to regard them as belonging to a single species (*Trichechus rosmarus*).

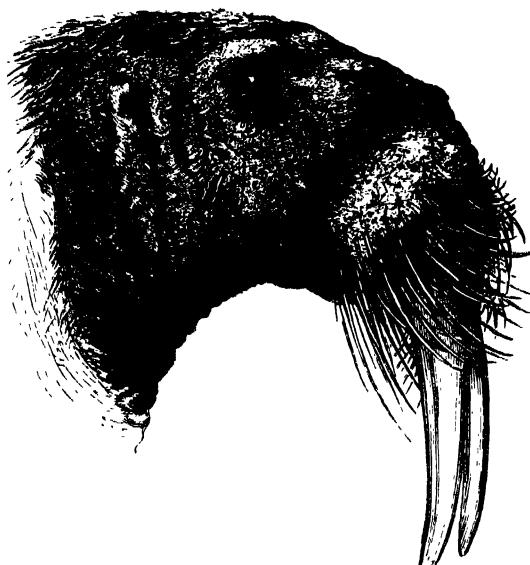
In many respects the walrus is nearly allied to the eared seals, this being especially shown in the structure of the hind-limbs. Thus the hind-feet are capable of being turned forwards beneath the body, and are employed in locomotion on land; while they have the three middle digits much smaller than the outer pair. Moreover, the toes of the hind-feet are similarly terminated by large lobes projecting far beyond the extremities of the bones; and the fore-limbs are nearly as large as the hinder ones.

The walrus differs, however, from the eared seals in the total absence of external ears, and also in its massive and clumsy build, as well as in the number and structure of its teeth. Thus the front portion of the skull is greatly swollen, and carries a pair of very long and laterally compressed tusks, or canine teeth,

depending from the upper jaw. In the adult animal internally to these tusks there is usually a row of four small teeth, of which in the young state the first is situated in advance of the latter, and is, therefore, an incisor; the other three being premolars. The lower jaw has but four teeth on each side, of which the foremost corresponds to the upper tusk, while the other three represent the premolars. Consequently, an adult walrus has but eighteen teeth altogether. The young animal has, however, two pairs of incisor teeth in both jaws, and five upper and four lower check-teeth; thus, with the tusks, bringing up the total number of teeth to thirty. We thus see that the young walrus presents resemblances to the eared seals in respect of the number of its teeth, which are totally lost in the adult animal. Our figure of the skeleton of the walrus shows the tusks in their full development; the illustration of the living animal being taken from examples with poorly-developed tusks. With the exception of these large upper tusks, all the teeth have low, blunted, sub-conical crowns, admirably adapted for crushing the molluscs on which these animals so largely subsist.

In comparison with the size of the body, the head of the walrus is rather small, and while squared and abruptly truncated in front is somewhat rounded behind; this rounded appearance being increased by the absence of all trace of external ears. The muzzle seems to be divided into two lobes by the vertical groove below the nostrils, and is furnished on either side with a number of stout translucent bristles growing from the upper lips. The eye is very small; and the entire head has a remarkably rugged and battered appearance; the lower jaw narrowing to a point between the upper tusks. The latter, which ordinarily project to a length of from 12 to 15 or more inches below the level of the gum, communicate, of course, the most striking and characteristic feature to the head, and indeed to the whole animal. Although relatively longer than in the true seals, the neck is shorter than in the eared seals, and gradually thickens posteriorly, where it imperceptibly merges into the trunk. The body is extremely bulky and ungainly, with a rounded outline, and diminishing gradually in size from the shoulders to the hind-quarters. The tail is very small; and the limbs are to a great extent enclosed in the skin of the trunk. There are five rudimentary claws on both the fore and the hind-feet, the soles of which are completely devoid of hair.

In the young of the walrus the body is thickly covered with short, yellowish brown fur, which is thinner and shorter on the under-parts and limbs than elsewhere,



HEAD OF WALRUS.

where it also becomes of a reddish brown or chestnut tinge. This fur persists till middle age, but in old age becomes gradually more and more scanty, frequently disappearing almost completely, or even entirely, from patches of larger or smaller



WALRUSES ON THE ICE ($\frac{1}{2}$ nat. size).

extent; while in some very old males of the Pacific walrus the whole skin may be almost naked. The skin over the entire body is thrown into a number of folds and wrinkles, these folds being heaviest in the region of the shoulders. The frequent fights in which these animals engage add a number of scars to the skin. Of four adult males measured by Mr. J. A. Allen the smallest had a length of $9\frac{1}{2}$

and the largest of 11 feet, from the tip of the snout to the root of the tail. Other individuals have, however, been recorded, measuring somewhat more than 12 feet in total length; but the statements of 15 or even 16-feet walruses must be received with hesitation. There is still much uncertainty as to the weight which these animals will attain. Parry gives the weight of an immature female as 1550 lbs.; while other trustworthy writers set down the weight of full-grown males at from 2250 to 3000 lbs. Larger weights have, indeed, been suggested, but it is probable that in those cases the estimates were far too high. In regard to the size of the tusks of the Atlantic walrus, a fine pair mentioned by Mr. Allen had a total length of 24 inches, of which probably about 18 inches would have protruded from the jaw during life; the weight of each of these being 4 lbs. Others have, however, been obtained with a total length of 31 inches, and a weight of upwards of 8 lbs. apiece; but such are, now at least, extremely rare. The tusks of females seldom exceed 20 inches in length. In the Pacific walrus the tusks are said to be longer and thicker, and more convergent; but we have not met with any account of their maximum dimensions.

In addition to this difference in the form of the tusks, the Pacific walrus has the muzzle proportionately broader and deeper, while the bristles on the upper lip are shorter and smaller. Important differences also occur in the form of the skull of the two varieties.

Distribution. The geographical range of the walrus has been considerably restricted in modern times owing to the incessant persecution of the animal in all accessible regions, and it is now exterminated in many places where it was formerly abundant. Its numbers have, indeed, been sadly diminished everywhere, and unless it receive prompt and efficient protection it is one of those creatures which stand a good chance of becoming extinct; this being more especially the case with the Pacific variety. The Atlantic walrus was known in Europe during the latter part of the ninth century, and appears to have been hunted on the coast of Finmark about a century later, while by the year 1600 walrus-hunting was a regular trade. Occasionally these animals wandered as far southwards as the coasts of Scotland; and they were abundant on many of the islands near the northern coast of continental Europe, and even on the shores of the continent itself; while eastward their range extended into Asia as far as the River Lena. Northwards the walrus appears to extend as far as vessels have penetrated. In 1600 it was very abundant on Cheric, or Bear Island, lying about two hundred and eighty miles to the northward of the North Cape, in Norway; no less than six or seven hundred having been killed on one occasion in six hours, while on another from nine hundred to a thousand were slaughtered in less than seven hours. The animals were accustomed to collect in large parties on the shore; and the plan adopted was first to shoot those nearest the sea, whose bodies then formed a barrier, cutting off the retreat of the rest. In less than eight years the walruses on Bear Island had become scarce and shy, and it was not long before they were completely exterminated. The retreating walruses were then followed to Spitzbergen and Greenland, and even there their numbers have so diminished that walrus hunting cannot be profitably conducted unless carried on in conjunction with whaling. Baron Nordenskiöld states that at the present day

the walrus is seldom found during summer on the west coast of Novaia Zemlia to the south of Matotschkin Skar, but that on the east coast of the same island, and in parts of the Kara Sea it is fairly common. It is but rarely seen in Iceland, but is not unfrequent on the coasts of Western Siberia.

In America the Atlantic walrus formerly ranged from Nova Scotia to about latitude 80° , and was at one time abundant in the Gulf of St. Lawrence and the eastern coasts of Newfoundland and Labrador. About 1534 walruses were very abundant on the Magdalen Islands in the Gulf of St. Lawrence; and many expeditions were soon after fitted out in Europe for the capture of the animals on these and adjacent islands. Till a few years ago, the heaps of walrus bones on the shores of the Magdalen Islands attested the slaughter that had taken place. According to Dr. A. S. Packard, the last walrus seen in the Gulf of St. Lawrence was killed in 1840; but a few have been observed subsequently on some of the neighbouring coasts and islands. In Greenland it was stated that about the year 1877 the walrus was only sparsely distributed in most places, with the exception of the tract lying between the 66th and 68th parallels, where it was sometimes met with in considerable numbers, and was regularly hunted by the natives in their canoes. Walruses also occur on the west coast of Baffin's Bay, and some of the islands to the north; but their range appears to be limited by the western shore of Hudson's Bay; and as they are not again met with till we reach Alaska, a large part of the coast of Arctic America is probably uninhabited by them.

Although the Pacific walrus has been known in Europe since the middle of the seventeenth century, it was not much molested by hunters till about the year 1860, by which date whaling had become much less profitable than it had been. The range of this variety was always much more restricted than that of its Atlantic cousin, reaching from the limit of ice southwards on the American coast as far as latitude 55° , and on the Asiatic shores to latitude 60° . In longitude its range to the north of Behring Strait in the Arctic Sea was limited to the eastwards by Point Barrow in Northern Alaska, and to the westward by Cape Chelagskoi, in longitude 170° , on the northern coast of Siberia. As on the latter coast the range of the Atlantic walrus did not extend eastwards of the Lena, the two varieties were widely separated from one another in this direction, as they also were in the opposite direction. On the Alaskan side of Behring Sea and Behring Strait the Pacific walrus was formerly found in enormous herds in Bristol Bay and Norton and Kotzebue Sounds; and in summer it also visited the Prybiloff Islands in large numbers. These animals were likewise common on the Aleutian Islands; but in the more southern portions of their range they were always sparsely distributed. Up to the year 1874 they were still found in innumerable herds where the waters of the Arctic Sea join with those of Behring Strait, and also in Behring Sea; but since that date their diminution has been rapid. It is stated that between the years 1870 and 1880 close on 2,000,000 gallons of walrus-oil, and 400,000 lbs. weight of ivory were obtained from these regions; thus representing the destruction of not far short of 100,000 animals. When the Russians first opened up the Prybiloff Islands, walruses were found in numbers on both St. Paul's and St. George's, but they soon retreated to Walrus Island, leaving the other two to their

less timorous cousins the sea-bears and sea-lions. It is stated that in a single year upwards of 28,000 lbs. weight of walrus-ivory was obtained from the Prybilofis alone.

In prehistoric times the range of the Atlantic walrus was much more extensive than during the historic epoch, on both the eastern and the western sides of the Atlantic. Thus its remains have been dredged up from the Dogger Bank off the eastern coast of England; while a skull was dug up from the peat near Ely, indicating that the animal formerly inhabited the valley of the Ouse, which was at that time probably an estuary. On the eastern coast of America walrus bones have been dug up as far south as New Jersey, Virginia, and even California. At a still earlier period walruses, which are considered to belong to an extinct species, inhabited both the eastern coast of England and the shores of Belgium; numerous remains having been obtained from the so-called crags of the Pliocene period in both countries.

Habits. There appears to be no well-marked difference between the habits

of the Atlantic and Pacific varieties. Walruses are usually found in the neighbourhood of shores or masses of floating ice, and are but seldom seen in the open sea. As a rule, they associate in companies or herds, depending in size upon the number of individuals in the particular locality. In addition to this fondness for each other's company, Baron Nordenskiöld states that curiosity is a distinguishing trait of the walrus, and relates how that when on one occasion he rowed right into the midst of a herd, "part followed the boat long distances quite peaceably, now and then emitting a grunting sound; others swam quite close, and raised themselves high out of the water, in order to take a view of the strangers. Others, again, lay so closely packed on pieces of drift-ice as to sink them down to the water's edge, while their comrades swimming about in the sea endeavoured with violence to gain a position on the already overfilled resting-places, though a number of unoccupied pieces of ice floated up and down in the neighbourhood." When on shore, or on an ice-floe, the various members of a party of walruses are described as huddling and pressing together against one another like pigs. From April to June, according to the latitude, is the breeding-season; and during this period the walruses are stated to remain on shore for about a fortnight, during which time they neither eat nor drink. Usually there is but a single young produced at a birth; and there is never more than a pair. The young are stated to be suckled by the parent for upwards of two years; and it is hence believed that the same female breeds but once in every three years. The females, while suckling their young, are said to assemble in herds apart from the males. Like seals, walruses appear to have circular breathing-holes in the ice, to which they can resort from below without exposing themselves. The voice of these animals is a loud roar, which in the case of large herds can be heard at the distance of several miles.

Unless molested, the walrus is stated to be gentle and inoffensive in disposition; but when attacked displays great fierceness and vindictiveness, while its huge bulk renders it a formidable antagonist, especially when its aggressors are afloat in a small boat. Not less noteworthy is the affection of the female walrus for its young, and likewise the sympathy of all the members of a herd for a

wounded comrade. When one of the herd is wounded, all its fellows are stated to combine together for its defence; and on such occasions the aspect of the animals is described as absolutely terrific. Either through confidence in their size and power, or from want of appreciation of danger, walruses when on shore or on the ice can often be approached very closely, and may thus be easily dispatched; they learn, however, greater caution with experience. In other cases they seem to be more vigilant on all occasions, having a certain number of their body acting as sentinels. In hunting them the great object is to cut off their retreat to the water, as if they once gain the open sea they generally escape. The number of walruses formerly found on the ice-floes of Spitzbergen was so great, and so thickly were the creatures crowded together, that an eye-witness wrote of them as presenting the appearance of solid islands of animals.

The walrus feeds chiefly upon thick-shelled bivalve molluscs,

Food. especially those commonly known as gapers. For crushing the shells of these molluscs the stunted and short cheek-teeth of the walrus are admirably adapted; but it appears that, after being broken, the shells themselves are rejected, and only the soft portions of the molluscs swallowed. This molluscan diet is also supplemented by fish and various crustaceans; while in addition to these, large quantities of sea-weed are also swallowed, although it is quite probable that their introduction into the creature's mouth is not intentional. It appears to be now ascertained beyond doubt that the chief use of the tusks of the walrus is to dig in the mud and ooze for the purpose of raking up the molluscs, on which it feeds so largely. Dr. R. Brown states, however, that he has seen walruses employ their tusks to aid in dragging their unwieldy bodies on to the ice, and also to aid their clumsy progress when on land. These observations are fully confirmed by Dr. Kane, who states that he has known walruses in this manner drag themselves on rocky islands to heights of sixty or a hundred feet above the level of the water.

The walrus is killed when on land or ice either by means of long

Hunting. lances, or with rifles; while when at sea it is chased with special boats and harpooned. Allusion has already been made to the enormous numbers of these animals killed in the Magdalen Islands, in the Gulf of St. Lawrence, in the sixteenth and seventeenth centuries; but one more instance of an enormous destruction of these animals may be referred to in greater detail. This occurred in the summer of 1852, on Thousand Island, lying off the south-west coast of Spitzbergen. Here, writes the narrator, Mr. Lamont, "two small sloops, sailing in company, approached the island, and soon discovered a herd of walruses, numbering, as they calculated, from three to four thousand, reposing upon it. Four boats' crews, or sixteen men, proceeded to the attack with spears. One great mass of walruses lay in a small sandy bay, with rocks inclosing it on each side, and on a little mossy flat above the bay, but to which the bay formed the only convenient access for such unwieldy animals. A great many hundreds lay on other parts of the island at a little distance. The boats landed a little way off, so as not to frighten them, and the sixteen men, creeping along shore, got between the sea and the bay, full of walruses before mentioned, and immediately commenced stabbing the animals next them. The walrus, although so active and fierce in the water, is very unwieldy and helpless on shore, and those in front soon succumbed to the

lances of their assailants ; the passage to the shore soon got so blocked up with the dead and dying that the unfortunate wretches could not pass over, and were in a manner barricaded by a wall of carcasses." The slaughter went on until the men were drenched with blood and thoroughly exhausted, while their lances became so blunt as to be useless. After returning to the ship to refresh themselves and grind their lances, the work of destruction was, however, resumed, and did not cease until upwards of nine hundred animals had been slain. Even then, however, so sluggish and lethargic were the walruses, that several hundreds were still lying on adjacent parts of the island. When the narrator visited the spot six years later the carcasses were still lying as they fell, in some instances two or three feet deep, and the stench from them was perceptible for miles out at sea. The worst feature of this great slaughter was, indeed, the circumstance that the perpetrators, owing to the size of their vessels, were only able to carry away a small proportion of their victims.

The walrus is hunted for the sake of its oil, hide, and tusks. The yield of oil is proportionately less than in the seals ; the amount obtained from the largest specimens seldom exceeding 500 lbs. ; and the quality also is stated to be inferior to seal-oil. The hides are chiefly exported to Russia and Sweden, where the leather is used for harness and the soles of boots and shoes, and also is twisted into tiller-ropes. The value of the hides in America is stated to be from two to four dollars per half skin. In thickness the skin varies from 1 to $1\frac{1}{2}$ inches. More valuable are the tusks, although their ivory is far inferior to that of elephants. The large amount of walrus-ivory annually obtained has been already mentioned ; and it may be added that, in America, while the price per lb. was only 40 or 45 cents in 1879, it had risen to a dollar or a dollar and a quarter in 1880 ; while in 1883 the price varied from four to four and a half dollars.

Another Scandinavian name for the walrus is *morse*, while to the Inuits the animal is known as the *awuk*.

THE TRUE, OR EARLESS SEALS.

Family *Pt*

With the true seals we come to the third and last family of the Pinniped Carnivores. These animals are at once distinguished from the eared seals and the walruses by the characters of the hind-limbs, which, as shown in the accompanying figure, are permanently directed backwards, and conjointly form a kind of rudder-like organ. Then, again, there is no trace of any external ear ; and the neck is shorter than in either of the two preceding families. As additional characters of the limbs, it may be mentioned that the front pair are always smaller than the hinder, and that the first digit or thumb of the former is always longer than the other digits ; while the whole of the digits are furnished with well-developed claws situated at their extremities. The hind-feet, which are incapable of the great expansion characterising those of the eared seals, usually have all the digits armed with claws, and generally want the long flaps of skin at their extremities, which characterise those of the eared seals. The number of front or

incisor teeth is variable in the different groups; but there are constantly five pairs of cheek-teeth in each jaw, of which the first four belong to the premolar series.

In all the species the under-surfaces of both the fore and hind-feet are covered with hair; while the fur clothing the body is invariably stiff and devoid of any woolly under-fur.

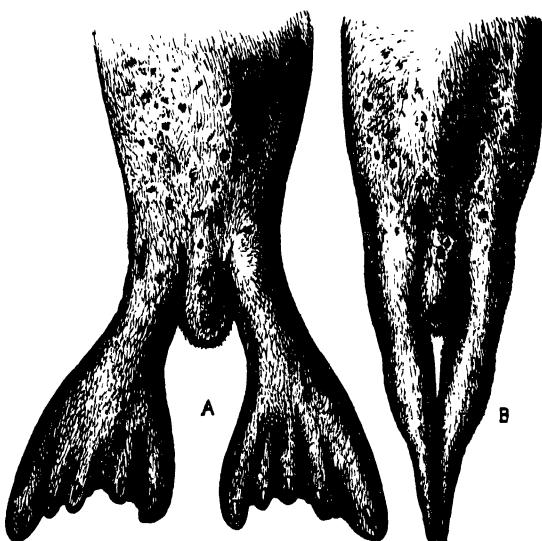
The true seals form a much less homogeneous group than the eared seals, and are arranged under several distinct genera; the total number of species being about sixteen or seventeen, although there is still a certain amount of doubt in some cases as to whether some forms should be regarded merely as local races or as distinct species. The greater number of the genera have but a single species each, and in only one of the genera does the number of species exceed two.

HIND-FLIPPERS OF RINGED SEAL—OPEN (A) AND CLOSED (B).

Distribution and Habits. True seals occur along the shores of the temperate and colder portions of the globe; but the greater number are found in the Northern Hemisphere. Moreover, with the exception of the elephant-seals, the seals of the Northern Hemisphere belong to genera distinct from those inhabiting the Southern Hemisphere; and the whole of the Arctic species are generically distinct from those of the Antarctic regions. Nearly the whole of the true seals are characterised by their strongly-developed social instincts and their extraordinary affection for their young. In disposition they are, as a rule, gentle and submissive, offering no resistance when attacked by man; although the crested seal of the North Atlantic is an exception in this respect. Many of the species are accustomed to assemble in large flocks during the breeding-season, while others are gregarious at all periods of the year. It is, however, only the elephant-seals that resemble the eared seals in passing a period of several weeks, during the breeding-season, entirely on land, and without partaking of any kind of food. As a rule there is but a single young one produced at a birth, and there is never more than a pair. All the seals are in the habit of spending a large portion of their time basking in the sun on sandy beaches or ice-floes.

Their food, of which a large quantity is necessary, consists chiefly of fish, but also comprises crustaceans and molluscs; and most of the species, like the eared seals, are in the habit of swallowing a number of pebbles.

As may be at once seen from the total absence of external ears and the structure of the hind-limbs, these seals are more specialised creatures than the eared seals, and are thus more completely adapted for an aquatic life. This is especially shown by the long period these animals can remain under water without coming



up to breathe. According to Dr. Robert Brown, the average time of a seal's submergence is from five to eight minutes, while the limit is set down by the same observer, at a quarter of an hour. Other authorities state, however, that the time may be extended to as much as twenty or thirty minutes. The sounds uttered by seals are various, in some cases taking the form of a kind of barking note, while in others they assume a more bleating tone, or even resemble the cry of a child; the note of the young being always more plaintive and less hoarse than that of the adult. In no cases, however, do they utter barking roars comparable to those characteristic of the eared seals.

The strange circumstance that young seals take to the water reluctantly, and have to be taught the art of swimming by their parents, would alone appear to be a sufficient indication that seals are originally descended from land Carnivores. Among some species the young remain entirely on the land or the ice for the first two or three weeks of their existence, or until they have shed their first coat of woolly hair. Numbers of seals are destroyed by the Polar bear, while others fall victims to the rapacious killer-whale. Others again are frequently destroyed by being jammed between ice-floes; and it is stated that thousands are sometimes killed by this means. The reduction in their numbers by all these causes are, however, trivial compared to those inflicted by man, who, according to Mr. J. A. Allen, requires about a million and a half to supply his annual needs. So reckless, indeed, has been the destruction of seals, that some species are already well nigh exterminated, while others have been so reduced in numbers as to render their pursuit no longer profitable.

Several species of seals inhabiting the Northern Hemisphere are in the habit of making long migrations, moving southward to avoid the intense cold of winter, and returning northward in summer; such migrations being most marked in the Greenland and the hooded seal. These movements have been carefully observed by Mr. J. C. Stevenson, on the Atlantic coasts of North America. The southern migration commences soon after the frost sets in; and at this season, he writes, "a fisherman, posted as sentinel on some headland commanding an extensive sea-view, communicates to the hamlet the first indication of the approaching host, the vanguard of which invariably consists of small detachments of from half a dozen to a score of seals. Such parties continue to pass at intervals, gradually increasing in frequency and numbers during the first two or three days of the exodus, by the end of which time they are seen in companies of one or more hundreds. The main body is now at hand, and during the greater part of the next two days one continuous uncountable crowd is constantly in sight. The whole procession coasts along at no great distance from the shore, presenting to an eye-witness a most extraordinary scene. In all quarters, as far as the eye can carry, nothing is visible but seals—the sea seems paved with their heads."

From the conformation of their hind-limbs, the true seals are unable to progress on land in the manner characteristic of the eared seals and the walrus; both the latter being able to bring their hind-limbs under the body by arching the back and carrying forward the hind-feet by a kind of jerk. Very generally the true seals move on land merely by a kind of wriggling motion of the body, with the fore-limbs held close to the sides of the trunk and the hind-limbs stretched out straight

behind. Dr. Murie has, however, ascertained that in the case of the Greenland and crested seals there is a kind of motion somewhat intermediate between the above and that characteristic of the eared seals. Thus the former of these two species "very often uses its fore-limbs, placing these on the ground in a semi-grasping manner, and, by an alternate use of them, drags its body along. The hind-legs meantime are either trailed behind slightly apart, or with opposed plantar surfaces slightly raised and shot stiffly behind. On uneven ground, or in attempting to climb, a peculiar lateral wriggling motion is made; and at such times, beside alternate palmar action, the body and the hind-limbs describe a sinuous spiral track." On the other hand, the common seal appears far less capable of making use of its fore-limbs in progression on land, these being only occasionally employed to obtain a hold on rocks.

On smooth ice seals are able to progress with considerable rapidity; the average rate being about one mile an hour in cool weather. Such journeys are always undertaken during the night; and the seals advance by raising their bodies from the ice by means of the fore-limbs, and then drawing themselves forward. On land, seals will occasionally travel considerable distances; and it is on record that in the winter of 1829 a grey seal in Norway travelled through the snow a distance of fully thirty miles; the time occupied in accomplishing this journey being believed to have been about a week, during which period the creature could not have touched food.

The true seals are not a very ancient group, geologically speaking, although their remains are found through the Pleistocene and Pliocene strata, and in a portion of those belonging to the Miocene period. Fossil seals are very common in the Pliocene deposits of Belgium; most of them being more or less nearly allied to the species now inhabiting the Northern Hemisphere. It is very noteworthy that while true seals range downwards to the Miocene period, no remains which can be definitely assigned to the eared seals have hitherto been discovered in any but the most recent and superficial deposits. If this apparently late origin of the eared seals be confirmed by future researches, it will go far to confirm the suggestion that the latter have taken rise from land Carnivores quite independently of the true seals.

THE GREY SEAL.

Genus *Halichærus*.

The grey seal (*Halichoerus grypus*), which is the sole representative of its genus, belongs to a group confined to the Northern Hemisphere, and distinguished from all the other members of the family by the presence of three pairs of incisor teeth in the upper jaw, and two pairs in the lower jaw. A further characteristic of the group is to be found in the presence of claws on all the toes of both pairs of limbs; while all those of the hind-feet are of nearly equal length.

The grey seal is at once distinguished from the other members of this group by the circumstance that the crowns of the relatively large cheek-teeth are composed of but a single conical cusp, although there may occasionally be fore-and-aft cusps in the last two teeth of the lower jaw. Another peculiar feature of these teeth is

that, with the exception of the last one or two in the upper and the last one in the lower jaw, they are implanted in the jaws by means of only a single root each.

The grey seal is a rather large species, full-grown males usually measuring about 8 feet in length, although occasionally reaching as much as 9 feet; these measurements being taken from the tip of the nose to the end of the hind-feet. The general colour of the fur is silvery or yellowish grey, becoming lighter on the under-parts, and marked with a number of blackish or dusky ill-defined spots. There is, however, great individual variation in this respect, some specimens being uniformly silvery or yellowish white, with little or no trace of spots, while others are almost black. The young are always white or yellowish white at birth, but, as a rule, soon acquire darker tints.

The grey seal, according to Mr. Allen, is one of the least common

Distribution. of the northern members of the family, and has a somewhat restricted distribution, being only found within comparatively narrow limits in the North Atlantic. On the shores of northern Europe it appears to be commoner than on the American side; and it occurs in Iceland, Scandinavia as far north as Finmark, the British Islands, and probably Greenland. It appears, however, to be unknown in Spitzbergen and the islands of the Arctic Sea, and is not met with, at all events as a regular inhabitant, on the shores of the English Channel. On the American coast this species extends as far south as Sable Island, off Nova Scotia, while northwards it is met with occasionally in the Straits of Labrador and Belle Isle, and ranges as far as Disco Island.

With the possible exception of the bearded seal, the present

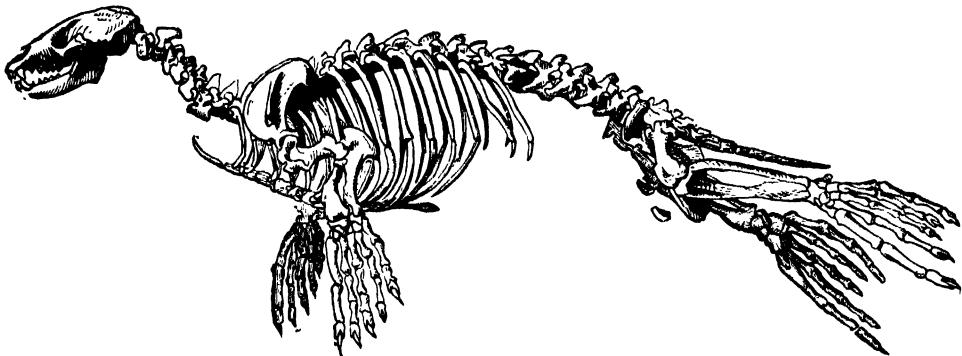
Habits. species is peculiar in breeding in the autumn; the young being produced in the Shetland Islands from September to November. There the grey seal is commonly found associating in pairs, and frequenting the most exposed positions. Describing the habits of this seal in the Gulf of St. Lawrence, Mr. Lucas writes that "it is fond of crawling out on the rocks, especially on sunny days, when it will lie basking in the sunshine for hours at a time. The seals do not come on shore at any convenient spot, but at a limited number of chosen localities, and these vary according to the force and direction of the wind. Except in very light breezes the lee-side of the island is selected, not entirely on account of the difficulty of effecting a landing on the windward side, but also because the seal relies very largely upon its acute senses of smell and hearing to warn it of approaching danger from the land. The chosen landing-places are where a shelf of rock, raised but little above the level of the sea, descends vertically for several feet beneath, thus enabling the seal to plunge head-first into the water and disappear at once from sight. Before landing, the animal will swim back and forth several times with head raised, and eye, ear, and nose on the alert to detect any sign of danger, the wary nature of the creature being well shown by the fact that almost immediately after emerging from the water the animal turns completely around so as to lie with the head seaward, and in readiness for an instant dive. The fairer the day and the lighter the breeze the more readily the seals come ashore, while during rough weather they not only do not land so often but are more watchful when they do come out." This species is less docile and intelligent than the common seal, and cannot be tamed in the same manner. A specimen measuring 8 feet in length weighed nearly 400 lbs.

THE COMMON SEAL AND THE GREENLAND SEAL.

Genus *Phoca*.

The common seal (*Phoca vitulina*) and the Greenland seal (*P. grænlandica*) may be selected as well-known examples of the genus *Phoca*, which is the only genus in the family containing more than two species. All the members of this genus differ from the grey seal by their smaller and more pointed teeth, but more especially by the circumstance that each of the cheek-teeth, with the exception of the first in each jaw, is implanted by two distinct roots, and has its crown composed of three or four compressed cusps arranged in a line. In such a tooth there is one large main cusp in the middle, which corresponds to the single cusp of the teeth of the grey seal; while in front and behind this are one or two much smaller cusps.

The common seal, which is the only species in addition to the **Common Seal** grey seal ordinarily met with on the coasts of the British Islands, is one of three nearly-allied forms, which in the young condition cannot always be



SKELETON OF THE COMMON SEAL.

satisfactorily distinguished from one another by colour alone. The three species in question are the common seal, the ringed seal (*P. hispida*), and the Greenland seal. All these three species are much smaller than the grey seal; the ringed seal being the smallest of all. The latter species can always be distinguished from either of the others by the greater length of the first digit in the fore-foot, which exceeds that of the other toes. When adult, the ringed seal is blackish grey above, with oval whitish rings, and whitish on the under-parts; its usual length varying from $4\frac{1}{2}$ to $5\frac{1}{2}$ feet. The common seal, on the other hand, can be easily distinguished from either of the others by its more massive teeth; the cheek-teeth being very broad and thick, and set obliquely and close together in the jaws, instead of being placed in the same straight line, and separated from one another by distinct intervals. It is, moreover, a relatively stouter-built animal, with a larger head, broader nose, and shorter limbs.

The adult of the common seal is very variable in colour, but the usual tint of the hair on the upper-parts is some shade of yellowish grey, with irregular dark brown or blackish spots; the under-parts being yellowish white, generally marked with smaller spots of brown. The length of the male varies from 5 to 6 feet. The

young when first born are yellowish white, and are peculiar in that they shed their woolly coat either on the day of birth or very shortly afterwards.

Distribution. The common seal has a much wider distribution than the grey seal, occurring not only in the North Atlantic but also in the North Pacific, and extending on the shores of both oceans to the Arctic regions, and thus being doubtless circumpolar. In the Atlantic it is found, though rarely, as far southwards as the Mediterranean, and on the American side as far as New Jersey. In the Pacific its southern limits appear to be marked on the Asiatic side by Kamschatka, and on the American by Southern California. It is, moreover, by no means confined to the coasts, but ascends some of the larger tidal rivers to a considerable distance from their mouths; and it has been known to pass up the St. Lawrence to the Great Lakes. In the North Atlantic this seal is strictly littoral in its habits, and always avoids the ice of the open seas. It is very common in Spitzbergen and Greenland; the number of individuals belonging to this species



THE COMMON SEAL.

and the ringed seal captured annually some years ago in the Danish settlements in Greenland being, according to Dr. Robert Brown, upwards of 700,000. In the British Islands, according to the authors of Bell's *British Quadrupeds*, this seal "is found all round the coast in suitable places, but is much less abundant than it formerly was, and has been quite banished from many places where it was formerly well known. It is common on many parts of the Irish coast, and is very abundant among the Scotch islands, especially in Shetland and Orkney. In Wales and Cornwall it is well known, but is now very rarely seen on the shores of the southern and eastern counties of England." Not many years ago one of them was observed on the beach at Brighton.

Habits. The common seal does not make any seasonal migrations, but is

found in the same haunts throughout the year. It prefers sheltered sounds and bays, with shallow water and an abundant supply of fish, to more exposed positions; and leaves the water at every tide to rest on the rocks or beach, almost invariably selecting such rocks as are separated from the mainland. The young are born in the latter part of May or June, and take to the water at an early

period. Like other members of the family, this seal is readily attracted by music, and will follow boats from which such sounds proceed to a considerable distance. Whether, however, this attraction by musical sounds is due merely to the curiosity characterising all the Pinniped Carnivores, or to an appreciation of the music itself, has not been ascertained. In disposition the common seal is more intelligent and gentle than most of its congeners; these qualities being displayed not only in the care and affection they bestow on their offspring, but likewise by the readiness with which they can be tamed, and their fidelity and affection for their masters. There are, indeed, many instances where these seals have followed their owners about like a dog; and some where they have come back to a house after every effort had been made to drive them away.



THE GREENLAND SEAL ($\frac{1}{6}$ nat. size).

Greenland Seal. Although the Greenland or, as it is often called, the harp, or saddle-backed seal, in its immature condition is not easy to distinguish from the common seal, in the case of adult males of the two species there is no sort of difficulty in this respect, the peculiar coloration of the Greenland species being amply sufficient. In the adult male, as shown in our illustration, the general colour is yellowish white or white; the nose and the fore-part of the head to behind the eyes are black; and there are very generally some black spots on the throat and chest. The most characteristic mark is, however, the irregular crescentic band of black on each side of the body, extending from the shoulders nearly to the tail; these bands being generally widest where they unite in the middle line over the shoulders. They may be interrupted posteriorly, but more generally join once more in front of the tail, so as to enclose an ellipsoidal

area. The length of the male is usually from 5 to 5½ feet, but may, it is said, be as much as 6 feet. The female has generally much the same coloration as the male when adult, but the black markings are less distinct, and may be wanting. The full coloration is not obtained till the fifth year, and so different is the appearance of the animal at different stages of its growth that the Greenlanders have distinct names for it according to age. The white or yellowish white woolly fur of the young is not changed for the hairy coat till several weeks after birth.

The Greenland seal, which can at most be regarded only as a very occasional visitant to the British Isles, is essentially a northern species, ranging in the Atlantic from Newfoundland and the North Sea to the Arctic regions, and also occurring in the North Pacific.

Habits. The migratory habits of this species have been already alluded

to at sufficient length; the most noted breeding-stations are Newfoundland and the vicinity of Jan-Mayen, at which localities these animals may be seen in enormous herds in the spring; but where they pass the remainder of the season is not ascertained. In Greenland these seals visit the coasts both in the autumn and in the spring; and it may be some of these herds that pass westwards to Jan-Mayen. During their migrations the seals keep close to the coasts, and frequently enter the bays and estuaries; but when settled at their breeding-resorts they prefer exposed ice-floes in the open sea, never resorting to the shores, and being seldom met with on the firm ice. Everywhere the Greenland seal is in the habit of assembling in immense herds; and it is so abundant that its numbers probably exceed those of all the other species put together. In consequence of this abundance, it is this species which forms the main basis of the sealing trade of the northern seas. Unlike the bearded and ringed seals, the Greenland seal never forms a breathing-hole in the ice; and this is doubtless the reason that it frequents the ice-floes rather than the continuous stretches of unbroken ice. Off the coast of Newfoundland the young are born in the early part of March, but in the Jan-Mayen district not until the end of that month. When assembled in their countless herds on the ice-floes during the breeding-season, it is stated that their cry may be heard at a distance of several miles, more especially if the ear be applied to the ice. As an indication of the enormous numbers in which these seals once existed, it may be mentioned that during the year 1866 a single steamer obtained 22,000 seals in nine days; and it was not uncommon for a ship's crew to kill from 500 to 800 adults and 2000 young ones in a day. In Greenland the annual catch was estimated at 33,000, while that in Newfoundland used to exceed 500,000, and in the Jan-Mayen seas the total number killed each year was fully 30,000.

Other Species. Of the remaining members of the genus *Phoca* our notice must be very brief. It has been already mentioned how the ringed seal (*P. hispida*) may be distinguished at all ages from the two preceding species, and reference has likewise been made to its adult coloration. It may be added that the ringed seal differs from the common seal by its more slender form, longer limbs and tail, narrower head, and more pointed nose. The ringed seal is an inhabitant of the Arctic and North Atlantic and Pacific Oceans, occasionally visiting the British Islands; but it may be regarded as pre-eminently boreal, its true home being the icy Arctic seas. Its favourite resorts are stated to be sheltered bays and fjords,

in which it remains so long as they are filled with solid ice; but when this breaks up the seals betake themselves to the ice-floes, upon which the young are born in the months of March and April. The ringed seal is not a migratory species, and in some localities is found in considerable numbers. It is one of those seals which make a circular "blow-hole" in the ice, through which they can ascend or descend at pleasure; such apertures being made while the ice is forming.

Nearly allied to the ringed seal are the Baikal seal (*P. sibirica*) and the Caspian seal (*P. caspica*), which are respectively confined to the inland seas from which they take their names. Both these seals are rather larger than the ringed seal, and are very similar to one another. Their especial interest is derived from



SEALS SWIMMING.

their habitat; the Baikal seal inhabiting a fresh-water lake, while the waters in which the Caspian seal dwells are but slightly salt. The curious part of the matter is that neither Lake Baikal nor the Caspian Sea appear to have had any recent connection with the Arctic Ocean; and if, as is most probably the case with the latter, we have to look to a former connection with the ocean to the southward, it becomes difficult to see whence came the stock from which these two allied species were derived. Mr. Allen has suggested, however, that the ringed, the Baikal, and the Caspian seal may be all descended from an allied extinct species whose remains are found in the Pliocene deposits of Belgium.

Lastly, we have the bearded seal (*P. barbata*), which is distinguished from all the other members of the genus by its superior size, its broad muzzle and convex

forehead, as well as by its small and weak teeth, some of which generally fall out in the adult. Moreover, the front flipper differs from that of all the other species in having the third or middle digit longer than the rest; whereas in the other species the digits decrease in size from the first or first and second together. The colour of the bearded seal is some shade of grey, darker on the middle of the back than elsewhere, but varying considerably in different individuals. In distribution the bearded seal is circumpolar and almost exclusively boreal, its only migration in winter being that due to the extension of the unbroken ice-fields, by which it is compelled to move somewhat to the southward. On the American side of the Atlantic this seal extends as far as Labrador, but not apparently down to Newfoundland. It is abundant on the coasts of Greenland, but in Europe does not appear to occur further south than Iceland and the North Sea.

The bearded seal is by far the largest of all the northern seals, full-grown males being said to attain a length of about 10 feet. An adult female skeleton, measured by Mr. Allen, had a length of 7 feet 2 inches. The species is said to be nowhere abundant, and is more or less solitary in its habits, never congregating in large herds. It is fond of basking upon large pieces of floating ice, and generally keeps well out to sea; and upon such occasions is easily approached and killed by the Eskimos. A distinctive peculiarity of this species is its habit of turning a complete somersault when about to dive, especially when fired at. The skin is thicker than that of any other northern seal, and is consequently valued by the Eskimos, who employ it in making their harpooning lines. Its flesh and blubber are stated to be more delicate in flavour than those of other species. Owing to its comparative rarity, the bearded seal is of no commercial importance; the total annual number caught some years ago in Greenland not exceeding a thousand.

THE MONK-SEAL.

Genus.

The monk-seal (*Monachus albiventer*) belongs to a group differing from the preceding by having but two pairs of incisor teeth in both the upper and lower jaws; and also by the first and fifth toes of the hind-feet being much longer than the others, and having their claws either rudimentary or absent. With the exception of the first in each jaw, the cheek-teeth are implanted by double roots; and the total number of teeth is thirty-two, against the thirty-four of the last group. The monk-seal is distinguished from the other members of the group by the character of its cheek-teeth; these being large, hollowed on the inner side, and marked with a prominent ring at the base, while the cusps on either side of the main cusp are very small. Moreover, the claws on all the toes are small and rudimentary. The fur is short, and is dark brown mingled with grey on the upper-parts, and whitish beneath. Full-grown males attain a length of from 7 to 8 feet, or more.

Distribution. Together with its ally the West Indian seal (*M. tropicalis*), the monk-seal is the only species of the family inhabiting the warmer seas; it is found in the Mediterranean and Black Seas, and on the coasts of the

neighbouring portions of the Atlantic, extending to Madeira and the Canary Islands. Although but little is known of its habits in a wild state, the monk-seal is very readily tamed, and is the species which used to be exhibited in England as the "talking fish."

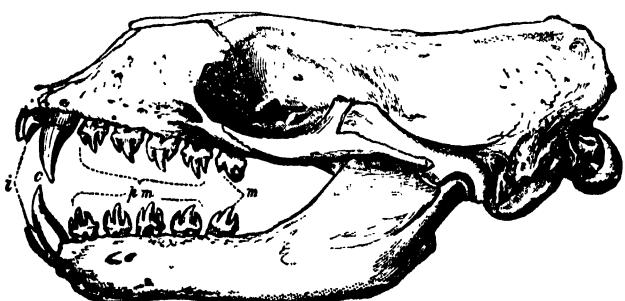
The closely-allied West Indian seal is of nearly the same colour **West Indian Seal**, as the monk-seal in the adult state, but the young are of a deep glossy black. This species is interesting from its restricted distribution, and the prospect of its impending extermination. Although discovered as far back as the year 1494 by the flotilla of Columbus, when cruising in the West Indies, this seal, up to the year 1883, was represented in scientific collections only by a single skin sent to the British Museum in 1846 by Mr. P. H. Gosse. In the year 1687, when Sir Hans Sloane visited the Bahamas, these seals were extraordinarily abundant, the sealers sometimes killing as many as a hundred in a single night. In less than two centuries they had, however, become exterminated from most of their former haunts, although some were known to remain on the rocky islands of Pedro Keys, to the southward of Jamaica. In 1886, as Mr. F. A. Lucas tells us, a vessel visited three small islands lying between Yucatan and Florida, known as the Triangles, with the hope of finding a colony of these seals. In this hope the expedition was not disappointed, upwards of forty specimens being secured before the vessel was compelled to put back from stress of weather. We are not told how many of these seals were then remaining on the islands.

It has been already mentioned that the seals of this group have the first and fifth toes of the hind-feet much longer than the others, and since this is a character which they possess in common with the eared seals, it is interesting to learn that the West Indian seal has the power of bringing the hind-feet forwards to a certain extent when on land by curving the body upwards. When straightening itself the creature pitches ahead on its breast, advancing about a foot by the operation.

THE LEOPARD-SEAL.

Genus *Ogmorhinus*.

The leopard-seal (*Ogmorhinus leptonyx*) may be taken as the best known



SKULL OF LEOPARD-SEAL.

representative of four genera confined to the Southern and Antarctic Seas, and each containing but a single species. These seals differ from the monk-seal by certain characters of their skulls, and are likewise distinguished from that species and from one another by the form of their cheek-teeth.

The leopard-seal or, as it is often called, the sea-leopard is distinguished by the great length of its skull, and by the cheek-teeth consisting of three large and

distinct cusps. The middle and largest of these cusps has its tip slightly inclined backwards, while the summits of the two smaller cusps are curved towards the middle one. Adult males of this species attain a length of as much as 12 feet. Moseley describes these animals as much resembling the common seal in coloration; the short and glossy fur being spotted yellowish white and dark grey on the back, and the under-surface of a general yellowish colour. The females are usually darker than the males, in which the ground-colour of the fur is often of a silvery grey.

Distribution. The leopard-seal has a wide distribution in the southern, temperate, and Antarctic seas, having been recorded from the coasts of New Zealand, Australia, and the adjacent islands, from the Falkland Islands, Kerguelen Land, and the shores of Patagonia, and being also found on the pack-ice in the Antarctic Ocean. It does not appear to be migratory, and is sometimes found on the ice or on islands in considerable herds. In Kerguelen Land it was still pretty common at the date of the visit of the *Challenger*, a herd estimated at four hundred in number being reported on one of the small islands adjacent.

Crab-Eating Seal. The first of the remaining members of this group is the crab-eating seal (*Lobodon carcinophaga*) of the Antarctic Ocean. It is of a nearly uniform olive colour above, with the sides of the face and the under-parts yellowish white, and sometimes a few light-coloured spots on the flanks. The cheek-teeth are even more complex than those of the leopard-seal, having one cusp in front of the large main cusp, and from one to three distinct cusps behind the latter. The claws are entirely wanting on the hind-feet. Practically nothing is known of the habits of this species.

Weddell's Seal. Weddell's seal (*Leptonychotes weddelli*) is another Antarctic species, distinguished by the teeth having simple conical and somewhat compressed crowns, without additional fore-and-aft cusps. It was originally obtained from the Southern Orkneys, but has also been obtained from Patagonia and the Antarctic pack-ice. The general colour is very similar to that of the leopard-seal, being pale greyish above, spotted with yellowish white on the back, and yellowish beneath. The jaw is weaker and the sockets of the eyes larger than in the leopard-seal.

Ross's Seal. The last of these four southern species is Ross's seal (*Ommatophoca rossi*), long known by two skulls and a single skin obtained from the Antarctic pack-ice during the voyage of the *Erebus* and *Terror* in the years 1839–1843, and appropriately named after the commander of that expedition. The fur is rough and coarse, with a general greenish yellow colour, marked with oblique yellow stripes on the sides of the body and paler on the under-parts. There are no claws on the hind-feet, and but very small ones in front. The skull is characterised by the immense capacity of the sockets of the eyes, and also by the small size of the teeth. The cheek-teeth have very small fore-and-aft cusps.

One of the two known skulls of this seal is peculiar in that, while on one side the first upper cheek-tooth and both the corresponding lower teeth are imperfectly divided by a vertical groove, on the opposite side of the upper jaw the place of this

tooth is taken by two complete simple teeth. Hence it is obvious that we have here a case where an originally single tooth divides into two distinct but simpler teeth. This may not at first sight seem a fact of much importance; but in reality it serves to show how the numerous simple teeth characteristic of the toothed whales may have been derived by the splitting up of teeth originally composed of three distinct cusps like those of the leopard-seal; each cusp of such a tooth forming, as we shall see, a distinct tooth in the whales.

THE CRESTED SEAL

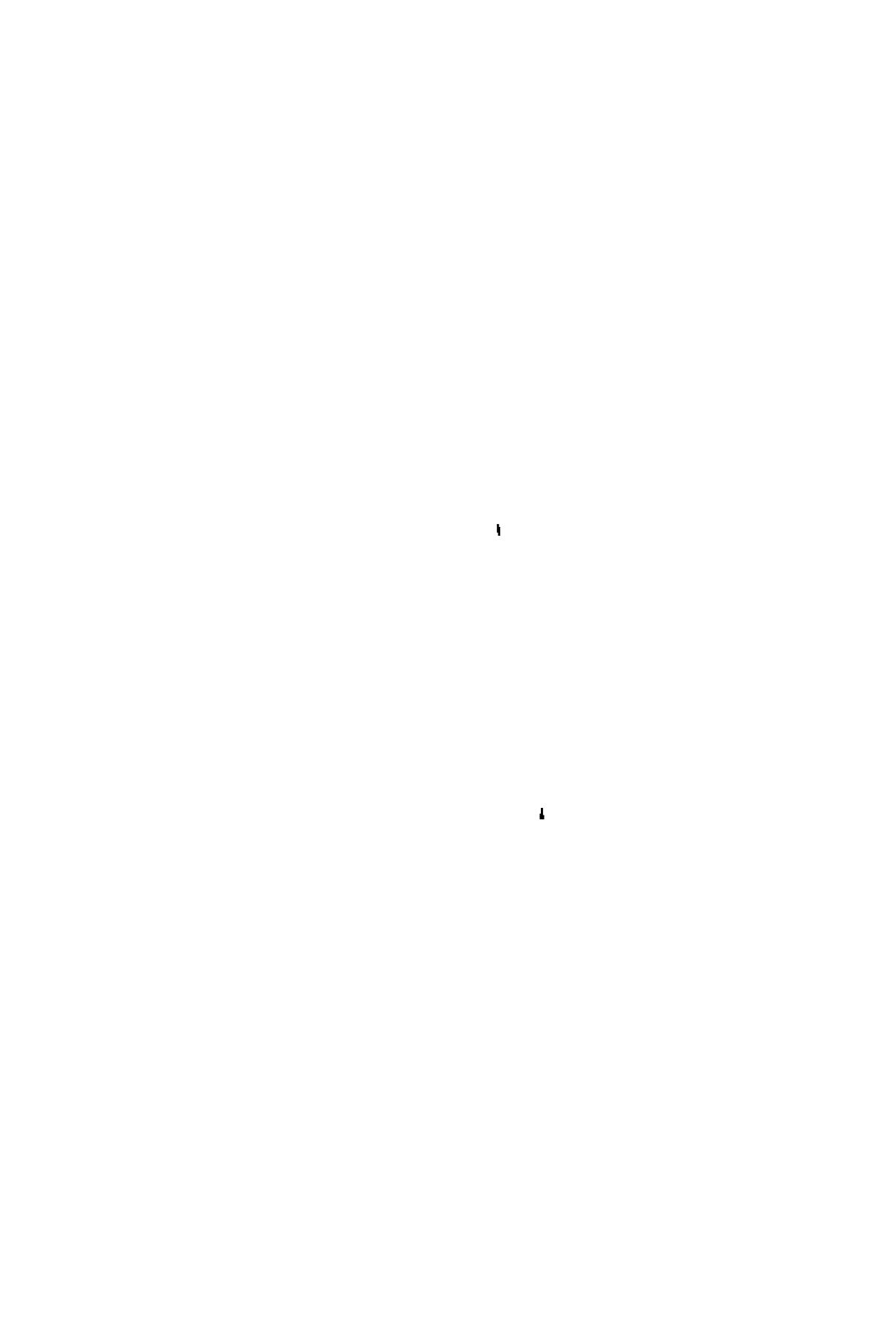
Genus *Cystophora*.

The remarkable-looking animal represented in the accompanying illustration, and commonly known as the crested, hooded, or bladder-seal (*Cystophora cristata*), is



THE CRESTED SEAL ($\frac{1}{2}$ nat. size).

at once distinguished from all the other members of the family by the casque-like prominence crowning the fore-part of the head. This seal, together with the under-mentioned elephant-seal, differs from all the species yet noticed in having but thirty teeth, owing to the reduction of the incisors to two pairs in the upper, and to one pair in the lower jaw. In both the cheek-teeth are small and simple, with,





LEOPARD - SEAL

in general, but a single root each ; and in the males of both the nose is furnished with an appendage which can be inflated at will. Moreover, the first and fifth toes of the hind-feet are considerably longer than the three middle ones, and are furnished with long lobes projecting in advance of the rudimentary claws, or the position which these should occupy.

In the crested seal the appendage on the nose takes the form of a large sac, which is in communication with the nostrils, and when inflated covers the head as far back as the eye ; but the female has no trace of this appendage, which does not make its appearance in the male till a considerable time after birth. The hind-feet of this species are provided with small claws ; and the last cheek-tooth generally has two roots. The ground-colour of the fur is bluish black, becoming lighter on the flanks and under-parts, and marked with small irregular whitish spots ; the head and limbs being uniformly black. Sometimes, however, the ground-colour is light greyish white, varied with dark brown or blackish spots. The woolly fur of the newly-born young is pure white. In size, full-grown males of this seal vary from $7\frac{1}{2}$ to 8 feet in total length ; females measuring about 7 feet. The skull is very short and broad ; and the bony partition dividing the nostrils is produced above the level of their margin in order to support the sac. This seal is restricted to the colder regions of the North Atlantic and certain portions of the Arctic Sea ; its range extending from Greenland eastwards to Spitzbergen, and thence along the northern coast of Europe. Southwards these seals are but seldom found below Norway on the one side, and Newfoundland on the other.

In habits the crested seal is essentially migratory and pelagic,

Habits.

travelling south in winter, and always preferring the drift-ice of the open sea to the neighbourhood of land ; indeed, it very seldom, if ever, resorts to the shores or even to outlying rocks. Compared with the Greenland seal, the present species is a comparatively rare one, and is nowhere met with in large numbers, although apparently more numerous in the Gulf of St. Lawrence than in most of its haunts. Although at times the sexes are said to live apart, they usually associate together in family parties or small herds during the breeding-season, previous to which the males engage in fierce contests for the possession of the females. While these fights are going on, the males utter cries which may be heard at the distance of several miles. The young are born on the ice, far away from land, during March ; and in defence of their offspring both parents will lose their own lives rather than escape by flight. In disposition the crested seal is much fiercer and bolder than any of the other members of the family ; and it will not unfrequently turn upon its aggressor, so that its pursuit in the frail *kayaks*, or canoes, of the Eskimo is attended with a considerable share of danger, the protection afforded to the head by the inflated sac rendering the males difficult to kill in the ordinary manner by means of clubs. What is the precise use of the appendage in question has not yet been fully determined ; but from its presence in the males only it may be inferred to be a sexual feature analogous to the antlers of the deer. It was estimated some years ago that the total number of these seals annually killed in Greenland did not exceed 3000. In addition to fish, the crested seal feeds largely upon cuttles and squids.

THE ELEPHANT-SEAL.

Genus *Macrorhinus*.

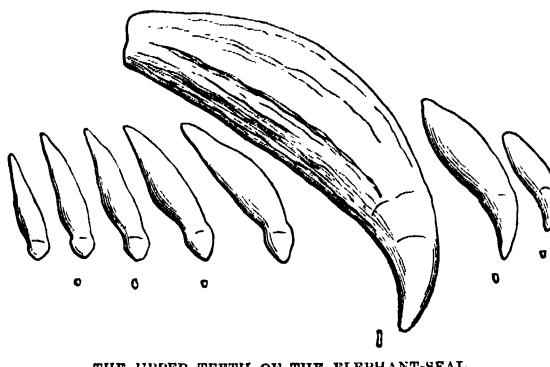
In the elephant-seal or sea-elephant (*Macrorhinus leoninus*) the appendage on the nose of the male takes the form of a short proboscis, which, though generally hanging in a limp condition, can be expanded and dilated at the will of its owner. The end of this proboscis is obliquely truncated, and penetrated by the nostrils, and the whole organ communicates a most peculiar and almost ridiculous physiognomy to the animal. The female, however, resembles an ordinary seal in the form of the head. The teeth (which are shown in the accompanying woodcut) are very

small in proportion to the size of the head; those of the cheek-series being of simpler structure than in the crested seal, and each inserted only by a single root. In the hind-feet the claws are wanting, and their first and fifth toes are longer in proportion to the others than is the case with the crested seal.

The elephant-seal is the largest of all the pinnipeds, not even excluding the walrus, adult males attaining a length of from 15 to 16 feet to the end of the body,

or, reckoning from the tip of the trunk to the extremities of the outstretched flippers, a length of 20 or 22 feet. When in good condition the girth of an old male will be as much as 15 or 16 feet, while the yield of oil from such an animal will reach 210 gallons. The females are much smaller, not exceeding 9 or 10 feet in total length. The general colour of the coarse and short fur is grey, with a more or less marked blackish or olive tinge, darker on the upper than on the under-parts.

Distribution. The typical elephant-seal formerly inhabited many of the islands in the South Atlantic, Pacific, and Indian Oceans, as well as those in the Antarctic Sea; some of its favourite haunts being Juan Fernandez, the Falkland Islands, Kerguelen Land, New Georgia, the South Shetlands, and Tristan da Cunha. In such places, during the earlier portions of this century and in the preceding one, these animals were met with in enormous herds, as described in the accounts of the voyages of Cook, Périon, and Anson. Northwards the elephant-seal reaches Patagonia, and extends some distance up the western coast of South America, but how far does not seem to be clearly ascertained, although it certainly stops short of the tropic of Capricorn. When, however, we have crossed the Equator and reached some distance north of the tropic of Cancer, elephant-seals are, or were, once more met with between latitude 25° and 35° on the coast of California. The difference between the Antarctic and Californian elephant-seals is very slight



THE UPPER TEETH OF THE ELEPHANT-SEAL.

The two on the right are the incisors, the next the tusk, and the five small ones to the left the cheek-teeth.—After Sir W. H. Flower.

indeed; and it appears that the chief reason that the American naturalists have for regarding them as distinct species is their isolated habitats. It may be that the area between these two habitats was once occupied by these seals, but the suggestion that the Californian race took origin from a few individuals that succeeded in crossing the tropical zone appears the more probable view, as it seems difficult to believe that the same species should inhabit both the Antarctic Ocean and the Equatorial seas. In any case, the Californian elephant-seal, whatever its origin, and whether it be a distinct species or only a local race of its Antarctic cousin, is, from a distributional point of view, of considerable interest, and its extermination, which, if not actually accomplished, must be imminent, cannot fail to be a source of regret.

Habits. In the southern seas the elephant-seals have long since been

practically exterminated from the Falkland Islands; and at the time of the visit of the *Challenger* Moseley states that, while elephant-seals had completely disappeared from Tristan da Cunha, they were still to be met with in Marian Island, were comparatively numerous in Kerguelen Land, and on the neighbouring Heard Island occurred in thousands. After mentioning an encounter with a male on Kerguelen Island, when the animal assumed a threatening attitude, and raised its tail nearly to the level of its head, as depicted in Anson's voyage, Professor Moseley goes on to state that, on the more exposed side of Heard Island, "there is an extensive beach, called Long Beach. This is covered over with thousands of sea-elephants in the breeding-season, but it is only accessible by land, and then only by crossing two glaciers. No boat can live to land on this shore, consequently men are stationed on the beach, and live there in huts; and their duty is constantly to drive the sea-elephants from this beach into the sea, which they do with whips made of the hide of the seals themselves. The beasts thus ousted swim off, and often 'haul up,' as the term is, upon the accessible beaches elsewhere. In very stormy weather, when they are driven into the sea, they are forced to betake themselves to the sheltered side of the island. Two or three old males, termed 'beach-masters,' hold a beach to themselves and cover it with cows, but allow no other males to haul up. The males fight furiously, and one man told me that he had seen an old male take up a younger one in his teeth and throw him over, lifting him in the air. The males show fight when whipped, and are with great difficulty driven into the sea. They are sometimes treated with horrible barbarity. The females give birth to their young soon after their arrival. The new-born young are almost black, unlike the adults, which are of a light slate-brown. They are suckled by the female for some time, and then left to themselves lying on the beach, where they seem to grow fat without further feeding. They are always allowed by the sealers thus to lie, in order to make more oil. This account was corroborated by all the sealers I met with. I do not understand it. Probably the cows visit their offspring unobserved from time to time. Péron says that both parent elephant-seals stay with the young without feeding at all, until the young are six or seven weeks old, and that then the old ones conduct the young to the water and keep them carefully in their company. The rapid increase in weight is in accordance with Péron's account. Goodridge gives a somewhat different account, namely, that after the females

leave the young, the old males and young proceed inland, as far as two miles sometimes, and stop without food for more than a month, and during this time lose fat. The male sea-elephants come on shore on the Crozets for the breeding-season at about the middle of August, the females a little later."

SEAL-HUNTING.

Although incidental mention has been made here and there of the annual catch of various species of the true seals, nothing has yet been said as to the various modes in which these animals are captured. The chief sealing districts, or, as they are technically called, "sealing-grounds," in the Arctic and North Atlantic oceans are West Greenland, the Newfoundland district, the Jan-Mayen seas, Novaia Zemlia and the Kara Sea, the White Sea, and the Caspian. The most important of these is the Jan-Mayen area, where, as in all the other districts except the Caspian, the Greenland seal is the species mainly hunted. So incessant and unremitting has been seal-hunting in the icy Jan-Mayen seas that the numbers of these animals have been very sensibly diminished; and as far back as 1871 attention was called to the necessity of some stringent regulations being applied to the sealing trade. This was followed in 1876 by an enactment on the part of the British Government establishing a close-time for seals, so far as their own subjects were concerned; and not long after similar action was taken by the other governments interested.

The chief sealing-trade in the North Pacific was the capture of the elephant-seals on the Californian coast—a trade which has of necessity come to an end by the extermination of the object of pursuit. In the more southern seas the trade was likewise confined to the capture of elephant-seals. From their great numerical abundance and their large size, the pursuit of these animals was an extremely lucrative occupation in the early years of this century. Now, however, as we have seen, these seals are exterminated from most of their former haunts, and only remain in any numbers on Kerguelen and Heard Islands, where they would also long since have disappeared had it not been for the inaccessible nature of the beaches they frequent. Consequently, the southern sealing-trade has now shrunk to an inappreciable fraction of its former volume, although there is a prospect of its being revived in the neighbourhood of the Antarctic pack-ice.

Of the various methods of capturing seals in the northern seas **Harpooning.** notably the oldest is that of harpooning from canoes, or *kayaks*, as now practised by the Eskimo. The kayak, which is made of skins, although upwards of eighteen feet in length, is so light as to be easily carried in the hand. In "sealing" the victim is approached within some twenty-five feet, when the harpoon is hurled from a wooden "thrower." The harpoon, in addition to its line, is furnished with a bladder attached by another cord, which marks the course of the seal while below the water, and enables the hunter to follow its track and wound it with his lance time after time as it comes to the surface to breathe, until it is finally despatched. The lance, it should be observed, is thrown from the hand, and, after striking the seal, always detaches itself and floats on the surface.

Netting. A large number of seals are also captured in nets, this method being chiefly employed during the spring and autumn visits of the migratory species to the shore. Nets appear to have been in use longest in the Gulf of Bothnia, the Caspian Sea, and Lake Baikal, where they are set either from the shore or beneath the ice. In the Gulf of Bothnia such nets are from 60 to 90 feet in length, and about 6 feet in depth. Two of them are generally set together in the neighbourhood of rocks to which the seals resort, and are always placed to the leeward of the mainland or some headland. When they strike against the nets, the seals thrust their heads through some of the meshes, and by twisting themselves about gradually become completely involved. In the Caspian Sea the nets are usually hung from boats at a considerable distance from the shore. In Lake Baikal, on the other hand, the nets are let down through the breathing-holes of the seals in the ice, and the animals become entangled on rising.

Seal-Box, etc. The seal-box used in parts of Scandinavia is a contrivance with a swinging plank, upon which, when the seal lands, it is precipitated headlong into a deep pit. Another Scandinavian plan is to surround a seal-rock with a line armed with a number of barbed hooks. These hooks allow the seals to land with impunity; but when a number of the animals are on the rock, and through a sudden fright rush headlong into the water, some of them are pretty sure to be caught. A third method employed in the same country is to fix a harpoon in a tube, with a spring-and-trigger arrangement, and to bury the whole contrivance in a hole bored in a seal-rock in such a manner that when a seal presses against the trigger the weapon will be discharged into its body.

A large number of seals are also shot on the shore with rifles; and others fall to the harpoon of the Eskimo, who either steals up to them while asleep, or awaits their rising at a breathing-hole. When a large number of seals can be surprised on shore at one of their favourite landing-places, clubbing is resorted to as the most effectual and speedy means of despatch; and it is said that sometimes as many as 15,000 have been killed in this manner in one night.

Capture on Ice. The above methods apply only to sealing on or near the shore;

Floes. but for the capture of seals on the ice-floes at long distances from land, vessels of some kind have to be specially equipped. In the Gulf of Bothnia these expeditions are or were carried out in open boats, each manned by eight sailors; but in the Newfoundland and Jan-Mayen seas steamers of considerable size are now employed. When the seals are found on the ice, they are killed in the same way as on shore, that is, either by shooting, harpooning, or clubbing.

Products. The most valuable product of the sealing industry is the oil, which is used both for lighting and for lubricating machinery. Writing in 1880 Mr. J. A. Allen states that the total annual quantity of seal-oil then obtained reached close on 90,000 barrels. Next in value to the oil are the skins, which are manufactured into leather of various sorts; a large number being used for lacquered leather. To the northern tribes seals are all important, furnishing not only the greater part of their food, but likewise most of the materials from which their boats and sledges are made, as well as their clothes and their hunting implements.

THE PRIMITIVE CARNIVORES.

No account of the Carnivores would be complete without some reference, however brief, to a number of peculiar species occurring in the Miocene and Eocene formations of Europe and America, which differ so remarkably from all living terrestrial representatives of the order, as to render it imperative to refer them to a totally distinct group. These extinct primitive, or, as they are technically called, Creodont Carnivores, differ from modern land Carnivores in the absence of a distinct flesh-tooth in either jaw; all the molar teeth of each jaw being constructed on the same plan, and the whole of those in the lower jaw being frequently like the single flesh-tooth of other Carnivores. As a rule, the crowns of the upper molar teeth are triangular in form, and of the type noticed on p. 340 of the first volume. And whereas in all existing Carnivores the two bones in the upper row of the wrist, technically known as the scaphoid and lunar, are completely welded together, in nearly all the Creodons they remain quite distinct. These and other characters indicate that these primitive Carnivores are a much more generalised group than the modern land Carnivores, of which they may have been the direct ancestors. Moreover, the teeth of many of these extinct forms are so like those of the carnivorous Marsupials (although agreeing generally in number with the modern carnivorous type, as exemplified by some of the dogs), that there is considerable probability that in these animals we have a direct connecting link between the Marsupials and the existing land Carnivores. The best known representatives of this group in Europe have been described under the names of *Hyainodon* and *Pterodon*; and while some of the species were no larger than a fox, others attained dimensions nearly or fully equal to those of a brown bear. There is little doubt that from some of these primitive Carnivores—and more especially the North-American forms known as *Miacis*—the majority of the existing land Carnivores are descended. It is noteworthy that an American and European genus known as *Palaeonictis* shows a remarkable gradation in the structure of its teeth towards the cats, although it is rather difficult to believe that the cats are directly derived from this primitive form.

C H A P T E R X X.

THE UNGULATES, OR HOOFED MAMMALS.—Order UNGULATA.

THE HOLLOW-HORNED RUMINANTS.

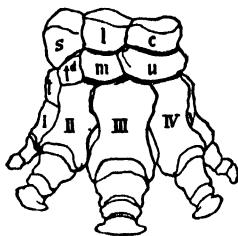
Family *BOVIDÆ*.

IF we except the bats, in which the outermost fingers of the wings are clawless, and some of the seals and their allies, the whole of the Mammals described in the preceding chapters are characterised by having the digits of both the fore and hind-limbs provided either with claws or with thin nails. Moreover, in the greater number of instances, the fore-limbs themselves are endowed to a larger or smaller degree with the power of free movement in several directions; these movements being displayed to the fullest degree among the Primates, where the hand can be rotated upon the fore-arm, although they are also well-developed in the Cat family. Then, again, the number of digits in the great majority of these animals is five on either one or both pairs of limbs, and in no instance is it less than four. Further, the crowns of their cheek-teeth are never complicated by vertical and lateral infoldings of the enamel, so as to produce when worn down an elaborate pattern.

The Ungulate, or Hoofed Mammals, such as cattle, deer, camels, swine, horses, tapirs, rhinoceroses, and elephants, of which we have now to treat, differ in many important respects from the above. Thus, while no existing member of the order has the feet provided with claws, in the great majority of cases the toes are enclosed in solid hoofs, although in a few instances they are furnished with broad and flat nails. Then, again, the movements of the fore-limbs are mainly or entirely restricted to a backwards-and-forwards motion, and in no case can the fore-foot be rotated on the fore-leg. Many extinct forms had five or four functional and well-developed digits to the limbs, but in all living members of the order, except the elephants, there are never more than four functional digits; and in a large number of instances these functional digits are reduced to two, or more rarely three in number. Some species, like the giraffe, have, indeed, but two digits to each foot, while in the horse and its living allies only a single digit remains.

**Feet of
Ungulates.** It must not, however, be assumed from the last sentence that the toes are gradually reduced from three to two, and from two to one; the fact really being that the reduction takes place along two different lines, in one of which the number is diminished from four to two, and in the other from three to one. As it is of primary importance, in order to understand the relationship of existing Ungulates to one another, to have a clear idea of the manner in which this reduction of the digits takes place, the subject may be dealt with in some detail.

In all the Ungulates the limbs have entirely ceased to be used as organs of prehension, and there would seem to be no necessity why there should be any adherence to the primitive five-toed type, as development advances. The majority of the members of the order being, however, unable to protect themselves against foes, and being also, in proportion to their height, heavy-bodied animals, the attainment of a high degree of speed was essential to their well-being and development, if not for their actual existence. For such a kind of life it will be obvious that the greater the length and slenderness of limb, the greater will at first sight be the speed. Now, in order to produce a long and slender, and at the same time a strong limb, from a stout and short-toed one, greater strength will clearly be attained by reducing the number of the toes, and lengthening and strengthening those which

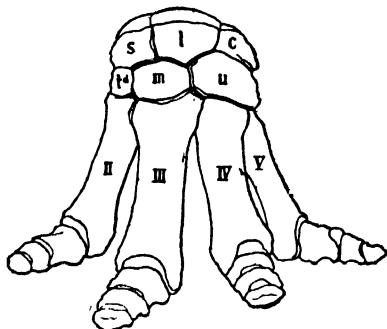


BONES OF THE LEFT WRIST AND FORE-FOOT OF THE CORYPHODON ($\frac{1}{4}$ nat. size).

The letters indicate the bones of the wrist (cuneiform, lunar scaphoid, trapezium, trapezoid, magnum, unciform), and the numerals those of the metacarpus.—After Osborn.

The letters indicate the bones of the wrist (cuneiform, lunar scaphoid, trapezium, trapezoid, magnum, unciform), and the numerals those of the metacarpus.—After Osborn.

remain, rather than by lengthening the whole of the five toes, the slender bones of which would be liable to fracture by the concussion of the solid hoofs against the ground. Accordingly, among the Ungulates, the plan has been to gradually lengthen and strengthen the bones of one or more of the original five toes, and at the same time to dispense more or less completely with the others. In almost the lowest Tertiary rocks of Europe and North America there occur, for instance, the remains of certain large Ungulates, known as coryphodonts, in which both the fore and hind-feet (as represented in the accompanying figure) have five complete toes. It will be observed that both the metacarpal bones and the toe bones by which they are succeeded are very short; and these animals must accordingly have walked to a certain extent upon the soles of their feet in the old-fashioned plantigrade manner.¹ It will also be noticed that the third or middle toe (III) is larger than either of the others, and symmetrical in itself.



BONES OF THE LEFT WRIST AND FOOT OF THE TITANO THERE ($\frac{1}{4}$ nat. size).—After Osborn.

Another feature of this type of foot is that the component bones forming the two horizontal rows of the wrist are placed almost vertically one above another, the bone lettered *l* merely touching the adjacent angle of the one marked *u*.

When we ascend to the overlying Miocene Tertiary deposits we meet with other large Ungulates having a foot of the type of that shown in our second figure, where it will be noticed that while all trace of the first toe (I) has disappeared, the metacarpal bones of all the others have become very much more elongated, in consequence of which the animal no longer walked upon the soles of its feet, but entirely upon the toes, or was, in other words, digitigrade. It will also be observed that the third toe has become

still larger in proportion to the others. Moreover, the upper row of wrist-bones

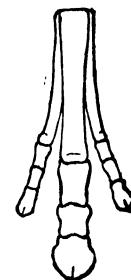
¹ As a matter of fact, the coryphodon was partially digitigrade in its fore-feet, but entirely plantigrade in the hinder ones.

appears to have been slid over those of the lower row towards the fifth toe, so that the bone marked *l* largely overlaps the one lettered *u*; and it will be obvious that this interlocking of the bones of the wrist produces a joint much more capable of resisting strain than is that of the coryphodon. The hind-foot of the titanotherium, as the extinct Ungulate we are now considering is called, exhibits a still further advance, having lost the fifth as well as the first toe, and thus being three-toed. The living tapirs are in a precisely similar condition, being four-toed in front and three-toed behind; but the rhinoceroses have advanced one step still further, having but three toes both in front and behind.

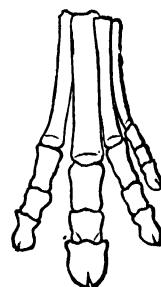
In the foot of the titanotherium, while the bones of the metacarpus have become longer than in the coryphodon, the toe-bones still remain as short as in the latter; and the same is the case with the rhinoceroses. All these are, indeed, bulky animals, fitted for dwelling in swampy localities, and not specially adapted for speed. In another group, however, as shown in our third figure, the toe-bones themselves have become elongated, while the metacarpal bones are still longer and more slender. In the feet represented in our third and fourth figures the middle or third toe is very much larger than either of the others; but whereas in the one the fifth toe still remains, in the other it is represented only by a rudiment of the upper end of its metacarpal bone. This type of foot leads on to that of the extinct three-toed horse, or *hipparion*, of the Pliocene Tertiary, shown in our fifth figure, where the two side-toes have become still smaller, and the last trace of the fifth has disappeared. Finally, at the very top of the geological series, we have the horse, where the only remaining toe is the third, now very large; the metacarpal bones of the second and fourth toes being represented solely by the small splints on either side of the large metacarpal, now known as the cannon-bone.

A complete transition has thus been traced from a five-toed Ungulate, walking partly on the soles of its feet, to one provided with but a single toe to each foot, and walking entirely upon the very tip of that one toe, by which means the full extent of the limb comes into play as an aid to speed. Throughout this series it is the third or middle toe which has undergone development at the expense of the others; and since this toe is always symmetrical in itself, the term Odd-Toed Ungulates is applied to the members of the group thus characterised.

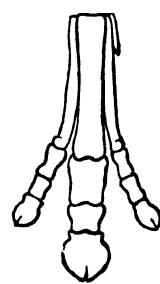
Odd-Toed and Even-Toed Ungulates. The resources of nature are, however, manifold, and instead of this being the only line of evolution of the Ungulates, nearly similar results have been reached by a totally different series of modifications. Starting once more from a foot somewhat similar to the one represented in the first figure of this chapter, it will be found that instead of the third toe remaining symmetrical in itself and gradually increasing in size at the expense of the others,



LEFT FORE-FOOT OF A THREE-TOED HORSE-LIKE ANIMAL.



BONES OF THE LEFT FORE-FOOT OF A FOUR-TOED HORSE-LIKE ANIMAL.



LEFT FORE-FOOT OF THE HIPPARION.

the third and fourth toes become symmetrical to a vertical line drawn between them. When this takes place the first toe disappears, and the second and fifth become diminished in size; an instance of this stage of development being presented



BONES OF FORE-FOOT OF HORSE.

by the pig, where the two large and medially-symmetrical toes represent the third and fourth of the typical series, while the two small lateral ones are the second and fifth. In the pigs¹ all the metacarpal bones remain distinct and relatively short; but in the water-chevrotain¹ of Africa the third and fourth metacarpals become much elongated and closely applied to one another, while the second and fifth are reduced to mere splints, and their toes so diminished as to become practically functionless. Finally, in the deer, oxen, and their allies, the third and fourth metacarpals in the fore-limb, and the corresponding metatarsal bones in the hind-limb, have become completely fused into a single rod-like bone, corresponding in function with the cannon-bone of the horse, and generally known by the same name. The dual origin of this cannon-bone is, however, proclaimed by the formation of its lower extremity, which carries two pulley-like surfaces, with which the bones of the two functional toes (the third and fourth) articulate.

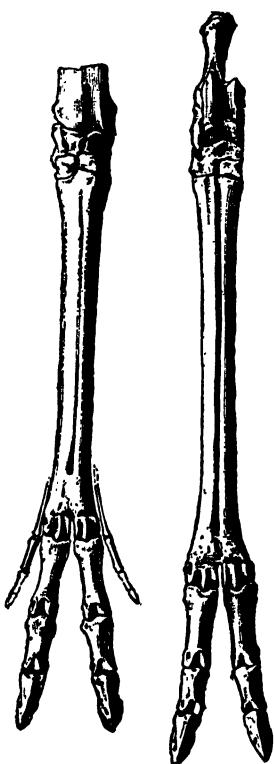
Since all the Ungulates displaying this second modification of foot-structure agree in having the third and fourth toes arranged symmetrically to a line drawn between them, they are collectively termed the Even-Toed Ungulates.

It is accordingly evident that although a few living Ungulates, like the elephant and the hyrax, retain a generalised type of foot, the greater number of the living representatives of the order are characterised by their more or less markedly specialised feet.

As regards their teeth, the Ungulates

Teeth.

are characterised by those of the cheek-series having broad crowns, surmounted either by columns or transverse ridges, and adapted for grinding and masticating vegetable substances. In the more specialised forms, like cattle and horses, these cheek-teeth have their columns or ridges of great height and closely approximated to one another, in consequence of which the bases of the hollows, or valleys by which these columns or ridges are separated from one another, cannot be seen when the tooth is unworn; while the pattern produced on the crown by the wearing down of these columns or ridges is complex. On the other hand, in the more primitive types, such as pigs and tapirs, the crowns of the cheek-teeth have low columns, or ridges, so that the bases of the intervening valleys can be distinctly seen at all

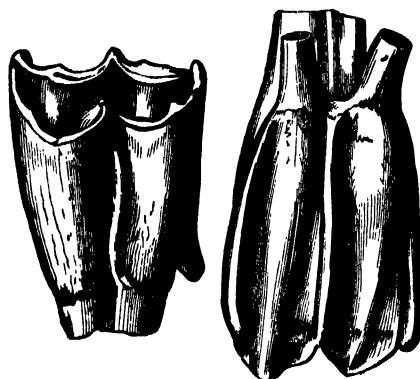


BONES OF THE FORE AND HIND- FEET OF AN EXTINCT DEER.

—After Osborn.

Figures of the bones of the feet of these animals are given under their respective headings.

stages of wear. This will be apparent from a comparison of the accompanying figures, the first of which shows a tall-crowned tooth viewed from the inner and outer sides, while the second shows a short-crowned tooth seen directly from above. In the former the valleys between the four crescent-shaped columns form deep pits, penetrating the whole extent of the crown of the tooth, while in the latter they are mere shallow channels. It will be found that while all the earlier Ungulates have short-crowned cheek-teeth, the greater number of living species have high-crowned ones; and it will also be observed later on that the development of high-crowned teeth has taken place independently in each of the four great groups into which existing Ungulates are divided. It should also be mentioned that whereas in Carnivores the upper molar teeth are generally of the primitive triangular type, in all existing Ungulates they have assumed the quadrangular form. The food of the Ungulates consisting in most cases entirely of vegetable substances requiring much mastication, is the inducing cause for the complex structure of the cheek-teeth in the more specialised kinds; and to the same cause may be attributed the circumstance that Ungulates always retain the full number of molar teeth, and, except in the camels, at least three out of the typical four premolars. In this respect they are in marked contrast to the Carnivores, in which, as we have seen, there is a great tendency to a reduction in the number of the molar teeth, only one living member of the order (the long-eared fox) having the typical three molar teeth in the upper jaw. On the other hand, among the more specialised representatives of the order, there is a decided tendency to the reduction, either in size or number, of the front teeth; the tusks being very frequently small or absent, while the whole of the incisor teeth, and sometimes the canines also, in the upper jaw, and more rarely both incisors and canines in the upper and lower jaws, may be wanting. All the earlier Ungulates, as well as the modern pigs, have, however, well-developed tusks, as well as the full number of front teeth; and it is thus apparent that in this respect also the result of specialisation has been the reverse of that in the Carnivores, where the tusks have obtained extreme development, and the full typical number of incisor teeth is very generally retained. In both cases these distinctions are due to the difference in the nature of the food and habits of the two groups of animals. In addition to these characters of their feet and teeth, the Ungulates of the present day are characterised by the total absence of collar-bones or clavicles in the adult condition, although traces of these may occur in the foetal state.



A LEFT UPPER MOLAR TOOTH OF THE NILGAI,
SEEN FROM THE INNER AND OUTER



A RIGHT UPPER MOLAR
TOOTH OF THE EX-
TINCT MERYCOPO-
TAMUS, VIEWED
FROM ABOVE.

**Definition of
Ungulates.** Having said thus much, it may be well to endeavour to briefly summarise the chief characteristics by which the existing members of the Ungulate order may be distinguished collectively from those of the other groups of Mammals.

In the first place, all Ungulates are adapted for a life on land; while, with the exception of some species of hyrax, none of them are arboreal. Then, whereas some of the more generalised forms are omnivorous, all the more specialised kinds are strictly vegetable feeders. In all cases the cheek-teeth have broad crowns, furnished with columns or ridges of greater or less complexity; and there are never less than three pairs of molar teeth in each jaw. Collar-bones are invariably absent; and the limbs are, as a rule, restricted entirely to a backward-and-forward motion, there being in no case any power of rotating the fore-foot or the fore-leg. The upper end of the radius, or smaller bone of the fore-limb, instead of being rounded, is accordingly elongated transversely in the typical Ungulates. The terminal joints of the toes are generally invested in solid horny hoofs, although in some cases furnished with broad and blunt nails, but never with claws. Moreover, the number of toes is but very rarely five, and may be reduced to three, two, or one; while in a large number of instances, where four toes are present, only a single pair are of any functional importance.

When, however, we have to take fossil species into consideration many of these characteristic features will not hold good; certain extinct Mammals, which it is very difficult to separate satisfactorily from the Ungulates, having either collar-bones, or claws, or perhaps both together. In others, again, the upper molar teeth, instead of having square crowns, show the triangular shape found in many Carnivores. Indeed, strange though it may seem, the connection between the early Carnivores and the early Ungulates is so close that it is frequently a matter of some difficulty to determine to which group an extinct form should be referred; and it is highly probable that the Ungulates are really a side-branch, descended from the same stock which gave rise to the Carnivores. This difficulty, or rather impossibility, of defining groups of animals, when we have to take into consideration their extinct relatives, is merely what must of necessity be the case if the doctrine of evolution be the true explanation of their mutual relationship.

Size. As a rule, existing Ungulates are characterised by their relatively

large size; and among the order are included the most bulky of all land mammals. There is, however, a great variation in point of size among the order; the smallest forms being the pigmy hog, the royal antelope, the chevrotains, and the hyrax; while the largest are the elephants, the hippopotamus, the rhinoceroses, and the giraffe.

Horns. A frequent, although by no means general peculiarity of the Ungulates is the tendency to the development of horns of some kind or other on the head; the nature of these horns, as we shall show later on, varying greatly in the different groups.

Distribution. The order is well represented on all the continents of the globe, with the exception of Australia, but at the present day it has a far larger number of species in the Old World than in the New; many of those from the former area belonging to groups quite unknown in the latter. Although repre-

sented in the Arctic regions only by the reindeer and the musk-ox, Ungulates are found alike in the coldest and the hottest regions of the globe. The maximum number of peculiar forms, as well as those of greatest corporeal bulk, are, however, inhabitants of the tropical and subtropical regions ; and it is also in the warmer regions that the greatest number of species occur. As regards the number of individuals of particular species, many Ungulates far exceed any other of the larger mammals ; this being especially the case with the bisons, that but a few years ago roamed in countless thousands over the prairies of North America, and with the myriad hosts of springboks in the South African veldt. Through the advance of civilisation and the incessant persecution of both the sportsman and the trader, these wonderful instances of the profusion of animal life have, however, been swept away for ever.

Not only are the Ungulates widely distributed in longitude and latitude, but they are also found at all elevations suitable for the existence of animal life ; some of the wild sheep of the Himalaya ranging to elevations of fully twenty thousand feet above the level of the sea. In time the order is an ancient one, being represented in the earliest stages of the Eocene division of the Tertiary period, although the species were mostly small, and in all cases widely different from any now living.

THE HOLLOW-HORNED RUMINANTS.

Family BOVIDÆ.

Unfortunately we have no concise English term to designate collectively the animals commonly known as oxen, sheep, goats, and antelopes, and we are hence compelled to allude to them by the periphrasis of the hollow-horned Ruminants, unless we prefer to call them by their scientific title, *Bovidae*. This is the more to be regretted, since the term hollow-horned Ruminants will likewise include the American prongbuck, which is the representative of a family by itself.

Taking, then, the term hollow-horned Ruminants, for want of a better, to designate the animals mentioned above, we have in this family our first representative of the Ungulate order. But before entering into the consideration of the especial characteristics of this family, it is necessary to point out those distinctive of the great group of even-toed Ungulates, under which title are included not only the hollow-horned Ruminants, but likewise deer, camels, swine, and many other living and extinct types.

Even-Toed Ungulates. It has been already mentioned that the even-toed Ungulates (or Artiodactyles, as they are technically termed), are distinguished by the third and fourth toes being almost equally developed, and arranged symmetrically on either side of a vertical line drawn between them ; this line being continued upwards to the wrist or ankle, and the metacarpal and metatarsal bones similarly arranged in respect to it. As a consequence of this it results that in the typical members of the group the hoofs are of the so-called "cloven" type. This character is alone sufficient to distinguish all the members of the group ; but there are a few others which it is advisable to mention. One of these characters is afforded by the cheek-teeth, in which the molars are almost always more complex

than the premolars. This is shown in the accompanying figure, where the first of the three upper molar teeth is shown on the left side, and is seen to consist of two lobes, while the adjacent premolar has but a single lobe. Another feature connected



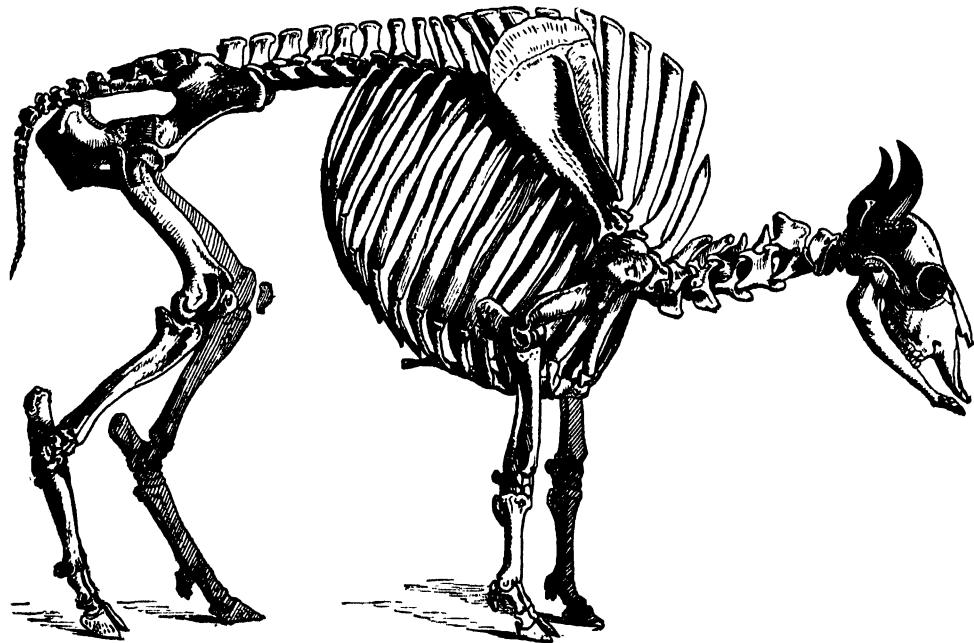
THE FIRST MOLAR AND THE THREE PREMOLAR TEETH OF THE RIGHT SIDE OF THE UPPER JAW OF THE FOUR-HORNED ANTELOPE.

with the teeth is exhibited by the last molar in the lower jaw, which almost invariably consists of three lobes; whereas in the living representative of the odd-toed Ungulates it has only two lobes. In their single-lobed upper premolar teeth the even-toed Ungulates show a retention of the primitive triangular type of tooth, which has been lost in the molar teeth. Then again the thigh-bone, or femur, in all the

members of the present group is characterised by the absence of any projecting process on the hinder surface of the shaft.

There are other less obvious distinctive features of the even-toed Ungulates, but the above are sufficient for our present purpose. It must be added, however, that both in this group and in the odd-toed Ungulates there are never more than four toes to each foot; and that all the members of both groups walk on their toes alone.

Ruminants. We are now in a position to consider somewhat more closely the characters of the hollow-horned Ruminants, but we have still to notice that these, together with the giraffe, the prongbuck, and the deer, form a



SKELETON OF THE EUROPEAN BISON.

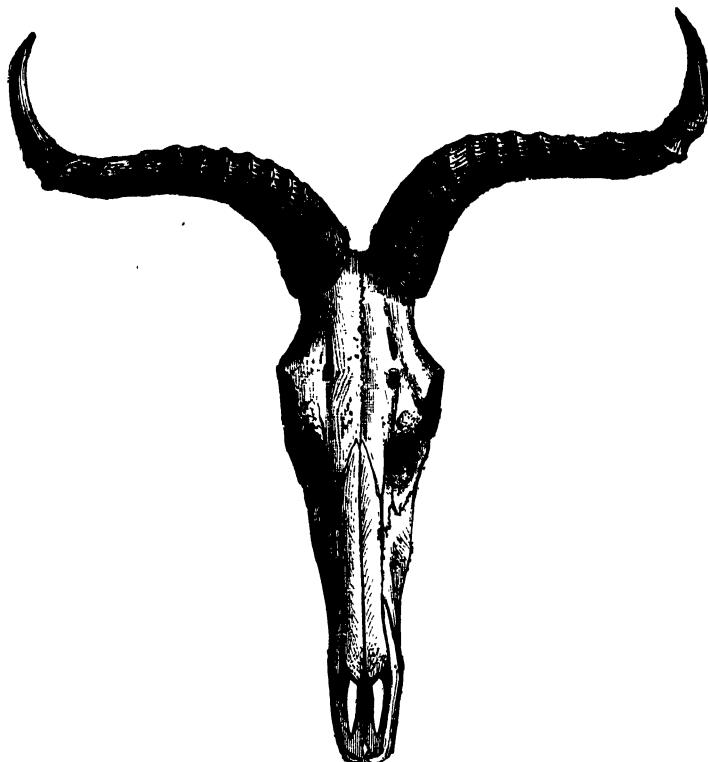
group distinguished from all the other even-toed Ungulates by certain important characters. In all the members of this assemblage of four families there are no front (or incisor) teeth in the upper jaw; and the upper tusks or canines are

generally small or absent. In the lower jaw, on the other hand, all the incisor teeth are present, while the canine tooth on each side is in immediate contact with the outermost incisor; and since all the three pairs of incisors and the single pair of canines have nearly similar spatulate crowns, they appear to form a single series of four pairs of teeth. This may be easily verified by examining the lower jaw of a sheep or an ox. The six cheek-teeth on either side of both jaws are placed close together; those of the lower jaw being separated by a long space from the four pairs of spatulate teeth. In the fore-feet the third and fourth metacarpal bones, and in the hind-feet

the metatarsal bones, are respectively fused into single "cannon-bones," as shown in the two figures given on p. 154; while the two lateral pairs of toes are always small and rudimentary, and may be completely absent; the toes themselves being encased in complete hoofs. Another peculiarity of this group is that the stomach is divided into four complete cavities, into the first of which the food is temporarily received, until it is regurgitated into the mouth, when it is completely masticated, and afterwards conveyed to the true digesting stomach.

This process is known as the function of "chewing-the-cud," or ruminating; and the Ungulates in which it occurs are consequently termed Ruminants. The ruminating function is, however, developed in the camels and chevrotains, as well as in the assemblage of four families constituting the present group; but as the camels and chevrotains differ in several important respects, it is convenient to designate the group under consideration as the true Ruminants, or technically, the *Pecora*.

It has yet to be mentioned that all the ruminating even-toed Ungulates are characterised by the peculiar structure of their cheek-teeth. It will be observed from the figure of the upper molar tooth of the nilgai given on p. 155, and also from that of the four-horned antelope on p. 158, that these teeth consist of four distinct columns, of which the innermost pair are crescent-shaped, with the horns



SKULL OF SWAYNE'S HARTEBEEST, TO SHOW HORNS.

(From Sclater, *Proc. Zool. Soc.*, 1892.)

of the crescents turned outwardly. In the lower jaw the molars are narrower, and with a reverse structure; that is to say, the crescents are on the outer side of the tooth, with their horns turned inwardly. Accordingly the name of *crescent-toothed* (*selenodont*) Ungulates is applied to all the ruminating members of the group.

It is important to observe that the true Ruminants are alone characterised by the whole of the four under-mentioned features, viz. no front teeth in the upper jaw, a four-chambered stomach, complete cannon-bones, and the feet encased in hoofs. Moreover, it is only in the members of this group that horns are ever met with; these appendages being always arranged as a symmetrical pair (occasionally two pairs) on either side of the middle line of the skull.

Hollow-Horned The hollow-horned Ruminants, or *Bovidae*, are distinguished from **Ruminants**. their allies by the presence of true horns; that is to say, of hollow and unbranched sheaths of horn growing upon bony protuberances, or cores, arising from the frontal bones of the skull, as shown in the figure on p. 159; neither the horny sheaths nor the bony cores being shed at any period of existence. In all existing wild species these horns are present at least in the male sex; but in many domesticated races of cattle, sheep, and goats, they are absent in both sexes; and the same holds good for certain extinct members of the family. Usually the molar teeth of the hollow-horned Ruminants are characterised by the great relative height of their crowns, as shown in the figures of the molar teeth of the nilgai given on p. 155; and in all cases there is no tusk or canine tooth in the upper jaw. In some few instances the small lateral toes may be completely absent, but they are generally represented merely by the small spurious hooflets alone, which may be supported internally by minute and irregularly-shaped nodules of bone.

The hollow-horned Ruminants are chiefly Old World forms, although they are represented in North America by the musk-ox, the American bison, the Rocky Mountain goat, and the bighorn sheep. They are quite unknown in the southern half of the New World.

THE OXEN.

Genus *Bos*.

The oxen include the largest and most massively-formed members of the hollow-horned Ruminants, and comprise not only the animals thus commonly designated, but likewise the bisons, yak, and buffaloes. As a rule, they are large and heavily-built animals, with very short and thick necks, and the massive and relatively short head carried nearly in the line of the back; the males generally being provided with a large dewlap, running along the throat from the chin to between the fore-legs. The tail is always long, and is generally thinly haired throughout the greater part of its length and tufted at the extremity, but in the yak it is thickly haired throughout. The muzzle is broad, naked, and moist; and there are never any "tear-pits" or glands below the eye, which are so frequently present in the antelopes; and in consequence of the absence of these tear-pits there are no depressions in the skull immediately below the eyes for their reception. The horns, which are present in both sexes and of nearly equal dimensions in both, may be either cylindrical or more or less markedly angulated; and are

usually situated in the immediate neighbourhood of, or actually upon, the summit of the skull, whence they generally sweep in a more or less outward direction, and then curve upwards, and sometimes inwards, at their extremities. They are never spirally twisted, or ornamented with prominent transverse knots or wrinkles. If the horn-cores be cut through, they will be found to be completely honeycombed by a number of irregular cavities of large size. The upper molar teeth are very tall and broad, and are provided with an additional column on the inner side, as shown in the figure of the tooth of the nilgai on p. 155.

Distribution. With the exception of the American bison, the whole of the existing species of oxen are confined to the Old World, where by far the greater number of species are continental. There is, however, one species, of smaller size than any of the rest, confined to the island of Celebes; and another which may, however, have been introduced, in the Philippines. Domesticated races are spread over nearly all the globe. The wild species inhabit either open grassy plains or dense forest, while one of them is confined to the higher regions of the Himalaya and Tibet. All of them live in herds of larger or smaller size, which are protected by the bulls; the number of individuals in these herds being in some cases reckoned by thousands, only the old bulls becoming solitary in their habits.

Habits. All cattle can swim readily, and some species will cross rivers of considerable breadth without the slightest hesitation. They are remarkable for their strength and endurance; and as beasts of draught oxen are superior to horses for dragging heavy vehicles through soft and yielding ground. The usual pace of these animals is a walk, but when excited they break into a heavy and awkward gallop. Their senses of smell and hearing are acute, but their sight does not appear to be particularly keen. Their food may consist either of leaves and the tender shoots of trees, grass, mosses, or various kinds of marsh and water-plants; and all the species display a marked partiality for salt.

Usually but one calf is produced at a birth, but there may be occasionally two. As is the case with other Ruminants, the calf is born in a highly-developed state, and is soon able to run by the side of its parent.

Specialisation. In most of their structural peculiarities the oxen appear to be among the most highly specialised of all the hollow-horned Ruminants; and this is confirmed by the lateness of their appearance in the geological series, the group being quite unknown before the Pliocene period, and attaining its maximum development in the Pleistocene and present epochs. Probably the origin of the group may be traced to Ruminants more or less closely allied to the antelopes; and it is noteworthy that in some of the extinct species horns were present only in the male sex.

THE AUROCHS AND DOMESTIC OXEN (*Bos taurus*).

The aurochs, or ancient wild ox of Europe, although now quite extinct as a wild species, is doubtless still represented by the half-wild cattle of some of the British parks; although the confined areas in which they live have caused them to degenerate sadly in size from their wild ancestors. Moreover, although there may

have been a certain amount of crossing with other species, the origin of our domestic cattle is certainly to be traced back to the same wild ancestor.

The aurochs and the half-wild and domesticated cattle of Europe are characterised by their horns being circular in section and placed at the very summit of the skull immediately over the occiput, as shown in the accompanying woodcut. Where they first arise from the skull the horns have their upper border convex; and the forehead of the skull is flat or slightly concave, and much longer than

broad, so that the sockets of the eyes are separated by a long interval from the bases of the horns. The tail is of great length. The spines of the vertebrae of the withers are not greatly elongated, and thus do not form a distinct ridge in this region of the body.

That the wild aurochs was an animal of huge bulk is proved by the skulls and bones found in the turbaries, fens, and

SKULL OF THE AUROCHS (about $\frac{1}{6}$ nat. size). - After Owen.

brick-earths of England and the continent. In the skull figured in the woodcut the bony cores of the horns have a span of upwards of 42 inches from tip to tip, and when these were covered with their horny sheaths the whole could not have fallen short of 50 inches. This specimen was obtained from a turbary—that is a peat-bog—near Athol; but some of the skulls found in the brick-earths at Ilford, in Essex, are of considerably larger dimensions, although from the more forward direction of their horns the span between their tips is somewhat less.

Distribution and Extinction. The aurochs was pursued and killed by the prehistoric hunters

of Europe, as we know from the circumstance that skulls have been found with the forehead pierced by flint hatchets. The date from which it disappeared from Britain is, however, uncertain, although it probably lingered longer in a wild state in Scotland than in the southern districts of England. On the continent there is evidence that in Julius Caesar's time the aurochs, or urus, was abundant in the Hercynian, or Black, Forest of Germany. Old chronicles also prove that in the middle of the sixth century these animals were found, although rarely, in the province of Maine; while there is evidence that some of them at least were white in colour. In the ninth century Charlemagne hunted the aurochs in the forests near Aix-la-Chapelle; while at the close of the following century we find the flesh of these animals alluded to in the rolls of an abbey in Switzerland. The aurochs was met with during the route taken through Germany by the first crusade, in the eleventh century; and that it still lingered in the neighbourhood of Worms during the twelfth century is indicated by the mention of the slaughter of four individuals in the *Nibelungen-Lied*. The accounts of conflicts with gigantic wild oxen, so rife in classic literature, doubtless refer to the aurochs; and thus

indicate that the range of the animal extended as far southwards as Greece. Bones of the aurochs have been obtained from England and Scotland, but are unknown in Ireland. On the continent they occur in France, Switzerland, Italy, Scandinavia, Germany, and Austria; while it may be taken as certain that the species roamed over Russia, although its exact eastern and northern limits are not ascertained. Southwards the aurochs ranged as far as Algeria.

The mention of a white aurochs, which may, however, have been a tamed individual, in one of the chronicles referred to above, coupled with the coloration of the Chillingham cattle, renders it probable that the colour of the aurochs was white, more or less mingled with dun and red; this inference being confirmed by the prevalence of these colours in so many of our domestic breeds of cattle.

Domestication. It is probable that the aurochs was the direct ancestor of our largest breeds of domestic cattle. At a very early period (although later than the epoch of the brick-earth, when the aurochs first existed) the inhabitants of Europe had succeeded in domesticating a small variety of ox, known as the long-fronted ox (*Bos longifrons*), from which it is considered probable that the small Welsh and Highland breeds of cattle are descended. If, however, we are right in our view that the whole of the cattle of Europe belong to one species, it is evident that the long-fronted ox itself must likewise have been originally derived from the aurochs.

Park-Cattle. Having said thus much as to the extinct wild cattle of Europe, we proceed to notice the half-wild races preserved in certain English and Scottish parks, after which we shall pass on to the consideration of the chief domestic breeds. It may be premised that while several of the former are probably much closer to the aurochs than are any of the latter, there seems but little doubt that in all cases these half-wild cattle are descended from more or less completely domesticated early breeds, and are not directly derived from the wild aurochs. The British park-cattle, when pure bred, are white in colour, with the exception of the ears and muzzle, and sometimes the front of the legs, which may be either red or black; the horns being white with black tips. In size these cattle are small; but their proportions are well-nigh perfect, their heads being small, their backs straight, and their legs short. According to Mr. J. E. Harting, herds of these cattle were formerly kept at all of the following parks, viz., Auchencruive (in Ayrshire), Barnard Castle (Durham), Bishop Auckland (Durham), Blair Athol (Perthshire), Burton Constable (Yorkshire), Cadzow Castle (Lanarkshire), Chartley Park (Staffordshire), Chillingham Castle (Northumberland), Ewelme Park (Oxfordshire), Gisburne Park (Yorkshire), Hoghton Tower (Lancashire), Holdenby Park (Northamptonshire), Kilmory House (Argyleshire), Leigh Court (Somersetshire), Lyme Park (Cheshire), Middleton Park (Lancashire), Naworth Castle (Cumberland), Somerford Park (Cheshire), Whalley Abbey (Lancashire), and Wollaton Park (Nottinghamshire). Of these numerous herds the only ones now remaining are those at Cadzow, Chartley, Chillingham, Kilmory, Lyme, and Somerford.

Chillingham Cattle. The best known of all is the famous Chillingham herd. There is some doubt as to the date of the enclosure of Chillingham Park, which, however, very probably took place early in the thirteenth century; and there is undoubted evidence of the existence of the herd rather more than two

hundred years ago. The Chillingham cattle are small, with moderately rough and curly hair, and short upwardly-directed horns. At the present day the insides of the ears and the muzzles are red; but it appears that in 1692 black ears were more numerous than red, and that the present coloration has been produced by selection. Mr. J. Hindmarsh, writing in the year 1838, states that the Chillingham cattle "have pre-eminently all the characteristics of wild animals, with some peculiarities which are very curious and amusing. They hide their young, feed in the night, basking or sleeping during the day; they are fierce when pressed, but generally speaking very timorous, moving off on the appearance of anyone, even at a great distance." The following statement of the numbers of the Chillingham herd at different periods is compiled by Mr. Harting from numerous accounts which have from time to time appeared. "In 1869, according to the steward's account, the herd consisted of only 14 breeding animals, bulls, and cows, and calves of both sexes, and 12 steers; in all 28. In 1838, according to Mr. Hindmarsh, there were about 80, comprising 25 bulls, 40 cows, and 15 steers of various ages. In May 1861, Mr. Darwin was informed by the agent that they numbered about 50. This was about the number we saw when visiting the park in May 1863. In August 1873 the herd consisted of 64 head, 17 bulls of all ages from calves upwards, 19 steers, and 28 cows, heifers, and female calves. In October 1874, according to Lord Tankerville (the owner), the herd numbered 71. In March 1875 the number had again decreased, amounting to 62 only, viz., 14 bulls and bull calves, 31 cows, and cow-calves, and 17 steers. In July 1877 there were still fewer—51 only—consisting of 8 bulls, 27 cows and heifers, and 16 steers. Lord Tankerville says they increase slowly, several dying each year by accidents or by overrunning their calves when disturbed; and the cows breed slowly, owing to having frequently the calves still sucking in the second year."

Cadzow Cattle. The Cadzow cattle, belonging to the Duke of Hamilton, of which a group is represented in our illustration, differ from the Chillingham breed in having the ears and muzzles black, while there is also a greater or smaller amount of black on the front of the fore-legs. Their heads are also more rounded, and their limbs stouter; and very generally the cows are devoid of horns. This herd is a very ancient one, and in 1874 numbered forty-five head, which in 1877 had increased to fifty-six.

Chartley Cattle. Very different in appearance to either of the above are the Chartley cattle, the property of Earl Ferrers. It is known that these cattle are the direct descendants of the wild cattle which roamed at large in the forest of Needwood at the date of the enclosure of Chartley Park in 1248. In this breed the ears are black, and the horns are longer and directed much more outwardly than in the Chillingham breed, resembling in these respects much more closely those of our domestic "long horns." In 1877 this herd comprised only twenty individuals.

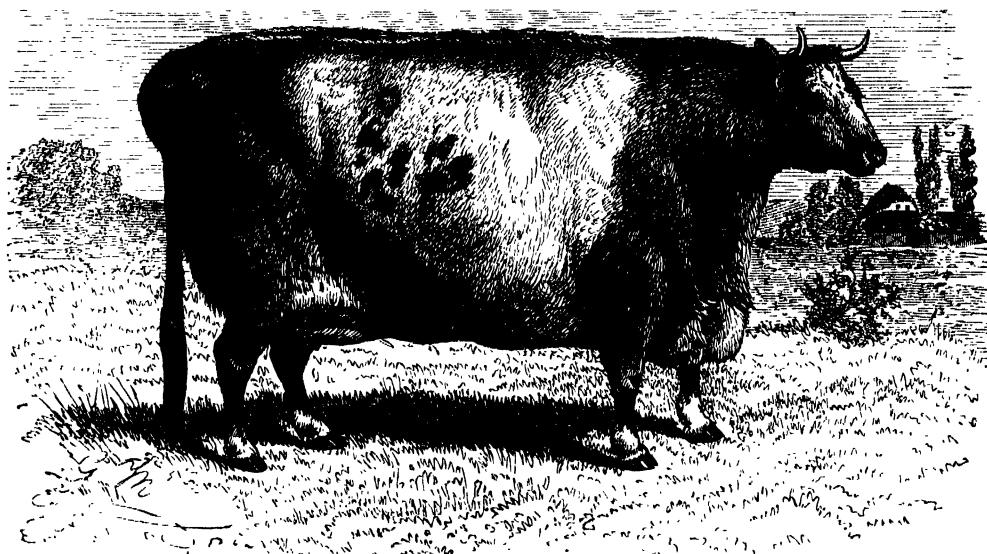
Other Herds. The Kilmory breed is derived from the one which formerly existed at Blair Athol. The Lyme Park breed is interesting as being of larger size than any of the others. The hair is remarkable for its length and curliness, more especially on the shoulders; the ears are generally red, although occasionally black or bluish black; and Mr. Harting describes the horns as inter-

WILD CATTLE OF CADZOW PARK.



mediate between those of the Chillingham and Chartley breeds. In 1875 this herd was reduced to four individuals, but had increased in 1877 to six, although one of the four cows was parti-coloured.

Of the breed at Somerford Park, situated in the heart of what was formerly Maxwell Forest, Mr. Harting writes that "an ancient herd of white cattle, resembling those at Chartley, but polled, still exists here; and these animals are considered to be the best surviving representatives of the hornless and tame variety of the original wild white breed. The colour is pure white; the ears, rims of the eyes, muzzle, and hoofs being quite black. Like all other herds of the forest breed they have a strong tendency to produce small black spots on the neck, sides, and legs."



DURHAM SHORTHORN ($\frac{1}{2}$ nat. size).

It may be added that all these various herds of white cattle are doubtless derived from the half-wild cattle which, as we learn from the writings of Fitz-Stephen, dating from about the year 1174, were common in the forests around London, and probably therefore in other parts of England. When the various parks were enclosed a certain number of these cattle were driven in, and the herds thus obtained have been preserved with more or less care by their subsequent owners.

Our notice of the domestic breeds of European cattle will be brief, and chiefly confined to those met with in the British Islands.

Shetland Cattle. First of all we have the small Shetland cattle, inhabiting the islands from which they take their name, but also extending to the Orkneys and Iceland. These cattle, although of small size, are esteemed on account

of their milk-yielding qualities, and the readiness with which they fatten. They have short horns, and are generally parti-coloured, with lighter shades of colour than the Highland breeds.

Highland Breed. The well-known Highland cattle, of which there are several strains, are characterised by their small size, the presence of horns, directed more or less upwardly, in both sexes, their short and sturdy limbs, and their rough and generally uniformly-coloured coats, which are greatly developed in the region of the neck. Generally the muzzle is black; but the colour of the hair may be either black or brown, or a mixture of these two, and sometimes of mouse-dun. These cattle are remarkable for their hardy habits, and vary in size according to the nature of the pasture of their native districts. Although far from good milkers, when brought down to the rich pastures of England they fatten readily. The West Highland breed is the finest, that of the Central Highlands the smallest, and that of the eastern coasts near the Lowlands the largest.

Welsh Breed. The Welsh cattle are best known by the Pembroke breed, and are generally of rather larger size than the Highland races, with yellow or orange-coloured unctuous skins; the hair being generally black. They are quite as hardy as the Highland cattle, and will thrive on very scanty nutriment, while they have the advantage of being much better milkers.

Kerry Breed. The Kerry breed is a well-known strain of hardy mountain cattle, agreeing in the colour of their skins with the Pembroke breed. The hair is generally black with a white streak down the back, and sometimes another along the belly; but it may be pure black or brown, black and white, or black and brown. The horns are long, tapering, and directed upwards. These cattle are valued for the good milking qualities of the cows, even when nourished upon inferior pasture.

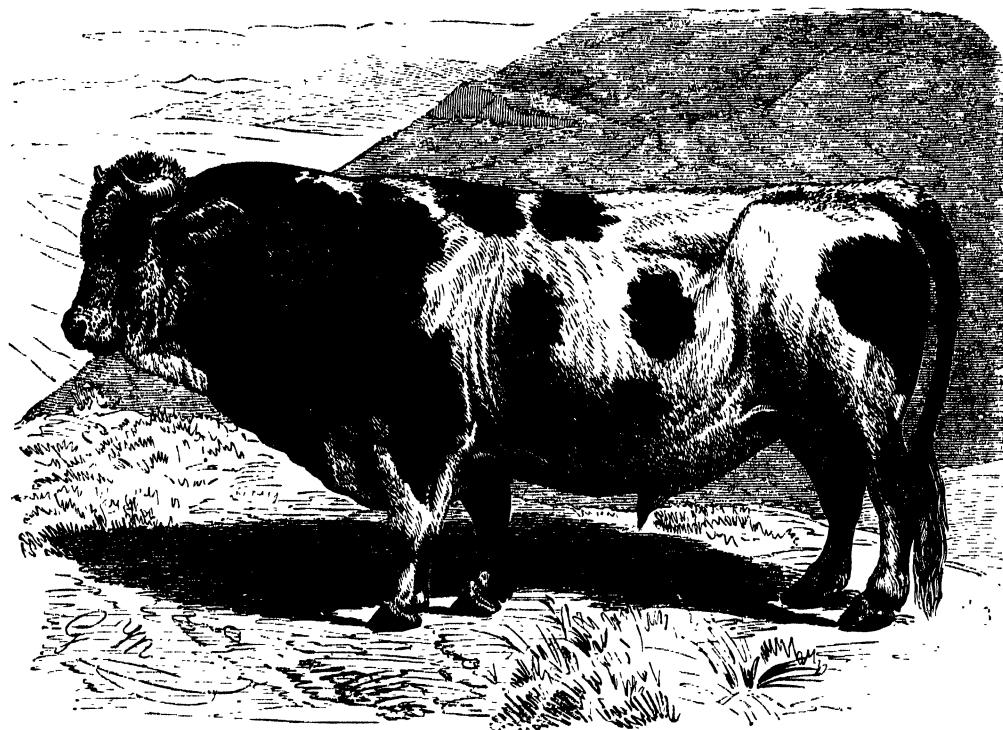
Polled Angus. The polled Angus breed, produced on the Devonian rocks of Forfar and Kincardine, are larger than the Highland cattle, from which they are readily distinguished by the absence of horns in both sexes. They are mostly black with white markings, but may be brindled black and brown; the skin being dark-coloured. This breed has in all probability been derived from the Highland cattle, and has attained its superior size and excellent milk-yielding qualities from having been reared on the richer pastures of the Lowlands. The polled Aberdeenshire breed is another strain of hornless cattle of mixed origin, bred in the lower districts of the county from which it derives its name.

Galloways. The Galloway breed is also a hornless one, and is of great antiquity, having been in existence at least since the sixteenth century. They inhabit a district underlain by Silurian and Cambrian rocks in the south-west of Scotland; and are essentially a mountain breed, being inferior in size to the polled Angus, although superior to the Highland breed. The skin is dark-coloured, and the hair generally black; while the great depth of the body will always suffice to distinguish this breed from all other polled strains. Mr. D. Low states that "these cattle are hardy, exceedingly docile, sufficiently good feeders, when carried to suitable pastures, and weigh well in proportion to their bulk."

Polled Suffolk. The polled Suffolk is a less important hornless breed from the eastern counties of England, which was originally of a mouse-dun, or

some nearly similar shade of colour, and is of small size, and somewhat defective form. There is also a polled Irish breed, which includes animals of large size, but frequently more or less crossed with other races.

Alderneys and Jersey. The three nearly-allied strains from the Channel Islands, respectively termed Alderney, Jersey, and Guernsey, are now so well known in England, and are so easily distinguished from all others, that they require but scant notice. They are characterised by the bulls being considerably larger than the cows, by their small size, their short, thin, and often crumpled in-turning horns, and their delicate and (from the butcher's point of view) somewhat "ragged" build. The head is delicately formed, with very prominent eyes, and a narrow



THE FRIBURG BULL ($\frac{1}{5}$ nat. size).

muzzle, but may be either very short or somewhat elongated; the bones of the pelvis are very prominent; and the limbs are slender and deer-like. The colour of the short and glossy hair is generally some shade of rufous or fawn, mingled with white; but it may be black, mixed with white or dun, and is more rarely cream; the skin being thin and orange-coloured. Although of delicate constitution, the Channel Island breeds are esteemed for their elegant appearance, and the richness and yellow colour of their cream and butter.

The Ayrshire breed, whose proper home is the county of Ayr, although it is now widely spread over Scotland and some parts of Ireland, is another race bred exclusively for the purposes of the dairy. They are of medium size, with short horns curving inwards in the Alderney manner; and the fore-quarters are light, the loins broad and deep, the neck and head small, and

the limbs slender. The colour of the skin is yellowish orange, and the prevailing tint of the hair reddish-brown, more or less mixed with white.

Devons. The rich red soil of Devonshire is tenanted by a breed of cattle readily distinguished by the deep red colour of their hair. They have orange-yellow skins and fine tapering horns. Mr. Low describes them as "of a light and graceful form, agile, and suited for active labour. They fatten with sufficient facility in good pastures, and in a temperate climate; but they are inferior in hardiness and the power of subsisting on scanty herbage to the mountain cattle of Scotland and Wales." The cows are relatively small, and their yield of milk not great, although excellent in quality and rich in cream.

Herefords. Omitting mention of the Sussex and Glamorganshire breeds, as being of minor importance, we pass on to the well-known Herefords, easily recognised by their large size, white faces, and dark red or reddish brown colour, marked more or less with white on the back and under-parts. Mr. Low considers this breed remotely related to the Devon; and it exhibits the same inferiority in the size of the cows, and a similar deficiency in the yield of milk. The breed is, however, an excellent one for fattening, and is hence in much favour in the West of England.

Longhorns. The longhorned breed, which is likewise from the West of England and is also largely reared in Ireland, is one which has of late years steadily declined in favour in this country. The original breed of longhorns was subject to considerable variation in size; but the prevailing colour of the hair was either black or brown, with a white stripe down the middle of the back, and more or less white on the body. The hair was abundant and the skin thick and dark. The long horns generally curved downwards at the tips; but in southern and eastern England they often turned up. Ultimately great improvements were effected in the breed, and the knowledge thus acquired paved the way for the gradual development of the shorthorns, by which the longhorns have been so largely supplanted.

Shorthorns. The shorthorn breed was originally an East Anglian race of cattle, but was modified into its present perfection in Durham, whence it is often known by the name of Durham shorthorn. The illustration on p. 167 represents an ox of the best strain of this breed. In these animals the height of the body is comparatively low, but there is great depth, and the chest, back, and loins are remarkable for their width. The skin is light-coloured, and the hair either reddish brown or white, or a mixture of the two, or the well-known strawberry colour. The muzzle should be flesh-coloured; and the horns are short, curving inwards, light in colour, and frequently somewhat compressed. The skin is soft and yielding, and the general form of the body square and massive, with upright shoulders and roomy hind-quarters. The great advantages of the shorthorns are that they are hardy and good-tempered animals, of large size and eminently distinguished by the rapidity with which they reach maturity of flesh and muscle. Although inferior in their yield of milk to the Suffolk and Ayrshire breeds, shorthorns are now more widely spread over England, both as dairy and fatting cattle, than any other kind.

Continental Breeds. On the continent there are likewise numerous breeds of cattle, but only a few of these can be even mentioned. One of the most esteemed is the Friburg breed, of which a bull is represented in the illustration on p. 169. This breed seems to be allied to the English shorthorns, but has a longer body and neck. The horns are short but sharp, and the colour is a mixture of black or reddish brown with white. These cattle are largely bred in Switzerland, and are considered to be the parent stock from which several other breeds have originated. The Dutch breed, as represented by the cow figured in the accompanying woodcut, was originally a native of the lowlands of Holland, but has now spread over a large part of Germany. Fitzinger regards the Dutch cattle



DUTCH COW ($\frac{1}{2}$ nat. size).

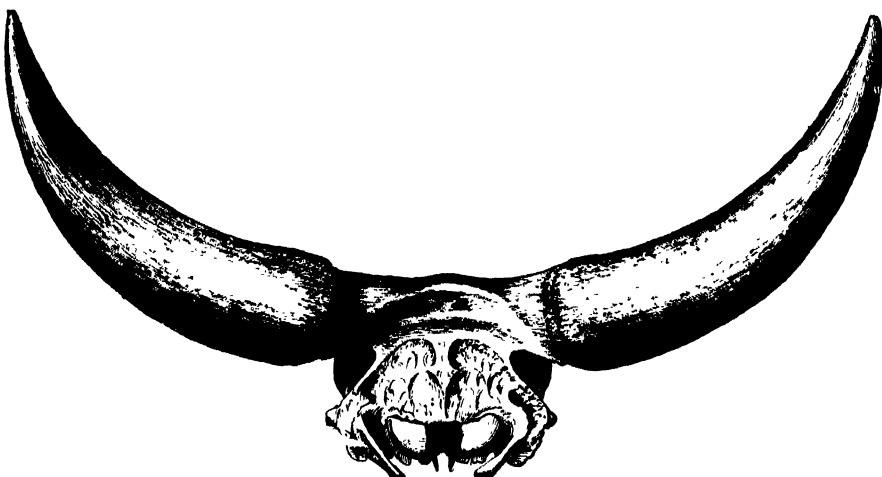
as the direct descendants of the aurochs, and they seem to approximate to the Ayrshire breed. They are of large size, with long necks and pointed muzzles, and moderate-sized horns, directed forwards and inwards. The usual colour is black upon a white or greyish white ground, but the dark markings may be brown or reddish.

Very different from all others are the large Hungarian cattle, characterised by their uniform pale fawn colour, their enormous, slender, outspreading horns, and their free light step. The horns may measure as much as 5 feet from tip to tip, and are black at the extremities, but greyish throughout the rest of their length. This breed ranges through Hungary into Turkey and Western Asia. The Podolian cattle constitute another well-marked breed characterised by the great relative height of the fore-quarters.

Indian Cattle. In Northern India many of the breeds of domestic cattle appear to be a cross between the ordinary European cattle and the humped Indian cattle, showing the general shape of the former but the white rings on the fetlocks characteristic of the latter. In Africa there are several kinds of humpless cattle, among which the Namaqualand breed most nearly resembles ordinary European cattle. On the other hand, the Damara breed is distinguished by the large size of the bones, the small feet, slender legs, the long tuft of bushy hair at the end of the tail, and the extraordinary length of the horns. The horns are, however, even still larger in the cattle of Bechuanaland, Mr. Darwin mentioning a skull in which the span of the horns is 8 feet 8 inches in a straight line, while the measurement from tip to tip along the curve is upwards of 13 feet 5 inches.

America and Australia. In certain parts of America, the Falkland Islands, Australia, New Zealand, and other countries, the cattle introduced from Europe have run wild, and form vast herds. Those found in Texas and on the Argentine pampas have become of a nearly uniform dark brownish red colour; while in the Ladrone or Mariana Islands, in the Pacific Ocean, all the wild cattle are white with black ears. When Lord Anson visited the Ladrones in the year 1742, the number of these cattle was estimated at upwards of ten thousand. In the Falkland Islands it is stated by Admiral Sullivan that those in the southern districts are white, with the feet, ears, or the entire head black; but in other parts they were either brown or mouse-coloured. The wild cattle of New Zealand, according to Herr von Lendenfeld, are white spotted with brown. In Australia the herds are of great extent, and are difficult to approach within shooting distance, on account of the wariness of the animals. In Argentina the cattle are very wild, but take little notice of a mounted man. If, however, as is seldom the case in a country where everybody rides, they are approached by a person on foot, they gallop around him in circles, with threatening gestures, looking every moment as if about to make a charge, although it does not appear that they ever do so. In company with two ladies, the writer has often wandered among such herds, without any harm, except some alarm on the part of one of his companions. In Colombia wild cattle are found not only on the plains, but likewise high up in the Cordilleras, and herds of considerable size have been met with in the highlands of Central Asia. Here may be mentioned the curious monstrous cattle found in Argentina and known as niatas or natas. This breed, which has existed for more than a century, bears the same relation to other races as is presented by pug-dogs to ordinary dogs. According to Mr. Darwin, "the forehead is very short and broad, with the nasal end of the skull, together with the whole plane of the upper molar teeth, curved upwards. The lower jaw projects beyond the upper, and has a corresponding upward curvature. The upper lip is much drawn back, the nostrils are seated high up and are widely open, the eyes project outwards, and the horns are large. The neck is short, and in walking the head is carried low. The hind-legs appear to be longer, compared with the front-legs, than is usual. The exposed incisor teeth, the short head and upturned nostrils, give these cattle the most ludicrous, self-confident air of defiance." Niatas appear to be very rare; but the writer had the good fortune to see a pair of them kept in the grounds of the

museum at La Plata in 1893. These were black and white in colour; and the characteristic features of the breed were much more strongly displayed in the bull than in the cow.



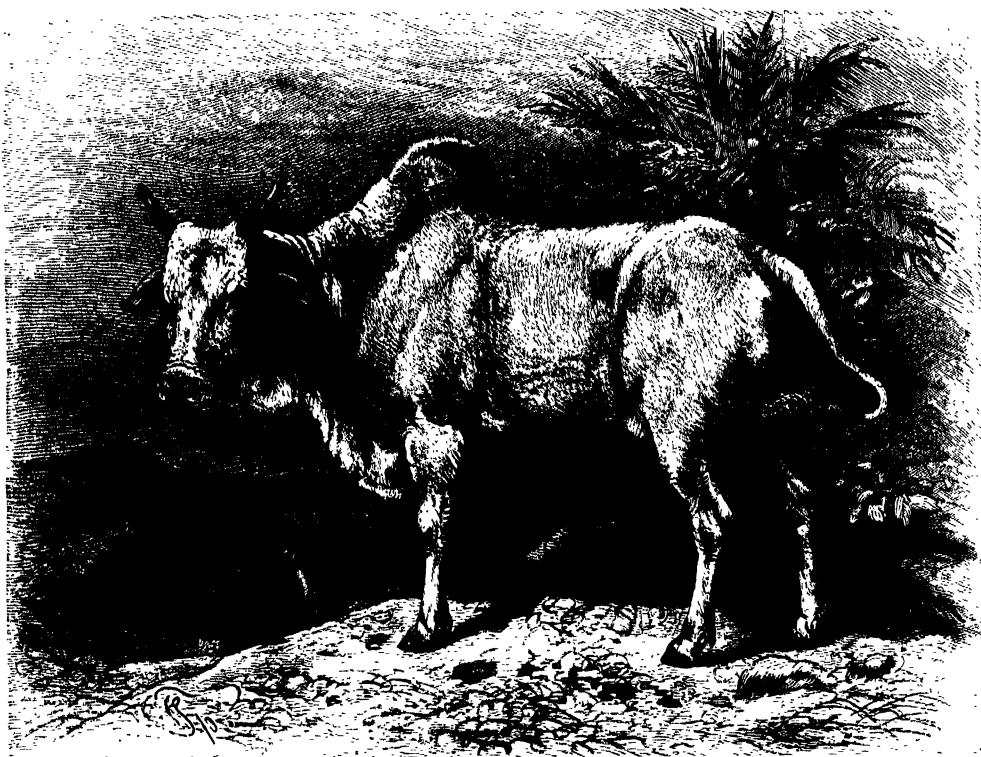
HIND VIEW OF SKULL OF GALLA OX, WITH THE HORN-SHEATHES REMOVED ($\frac{1}{6}$ nat. size). After Rütimeyer.

HUMPED CATTLE (*Bos indicus*).

The common domesticated cattle of India are distinguished from those of Europe, not only by the presence of the hump on the withers, but likewise by other structural features, as well as by their general coloration, their voice, and their habits. Hence, although they are only known in the domestic state, there can be no hesitation in regarding these humped cattle as constituting a perfectly distinct species. In Europe these animals are generally called zebu, but it does not appear that any such name is known in India.

In addition to the enormous hump on the withers, the Indian humped cattle are characterised by a certain degree of convexity of the forehead, by the upper border of the short horns being uniformly concave (as shown in the figure of the skull of the African variety), by their large drooping ears, and also by the enormous dewlap which hangs in folds along the whole length of the neck. In size and colour these cattle are subject to a considerable amount of variation, but they are very generally characterised by a distinct white ring round the fetlocks. While the largest individuals stand as high as a buffalo, the smallest are but little taller than a calf of a month old. The most common colour is a light ashy grey, which may shade off into cream-colour, or even milk-white; but various tints of red or brown are often met with, and occasionally black individuals are seen. In disposition these cattle are always gentle, and the larger varieties are employed in India for drawing native carriages. The voice of the humped cattle is more of a grunt than a low; and these animals differ from European cattle in habits, insomuch as they but seldom seek the shade, and never stand knee-deep in water. It need hardly be mentioned that a certain number of privileged bulls are specially protected by

the Hindus, and are allowed to perambulate the bazaars of the Indian towns at will. In certain parts of India humped cattle have run wild; those found on the sea-coast near Nellore, in the Carnatic, have been in this state for a long period, and Jerdon describes them as being extremely shy and wild, their size being large and their horns long.

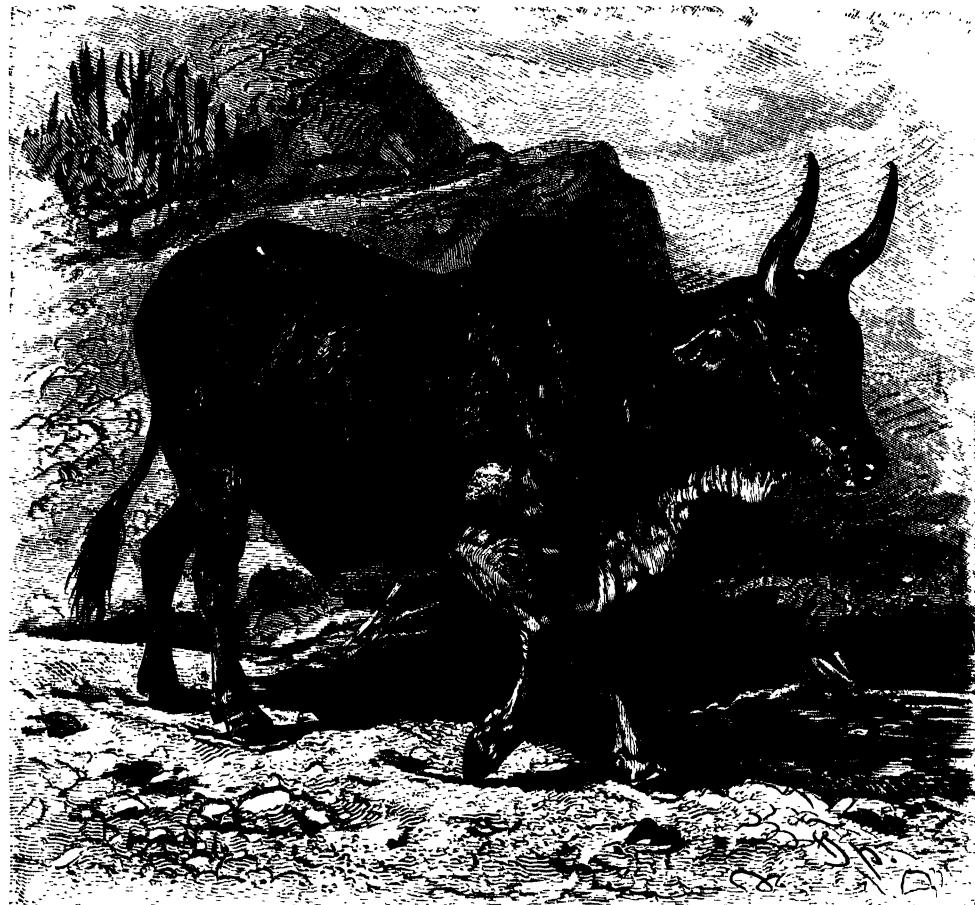


INDIAN HUMPED BULL ($\frac{1}{2}$ nat. size).

Humped cattle are also found in China, Africa, and Madagascar; **Galla Cattle.** and Blyth was of opinion that the group might have had an African origin. In Central Africa the humped cattle are represented by the Galla ox or sunga, characterised by the enormous size and thickness of the horns, as shown in the figure of the back of the skull on p. 173. In this breed the forehead of the skull lacks the convexity characteristic of the Indian humped cattle; and as the curvature of the horns is somewhat similar, Professor Rütimeyer believes that the Galla ox is most nearly related to the Asiatic banting mentioned later on.

In concluding our notice of the typical oxen it may be mentioned that several species occur fossil in India. Among these is the magnificent Narbada ox (*B. namadicus*), of the gravels of the valley of the Narbada, which was fully equal in size to the aurochs, and in the typical form had horns with a cylindrical section. It is, however, noteworthy that in one race of this species the horns were somewhat flattened, and thus approximate to those of the living wild cattle of India. In the somewhat older deposits of the Siwalik

Hills there occurs the gigantic sharp-fronted ox (*B. acutifrons*), distinguished by the sharp ridge running down the middle of the forehead, and the enormous length of the horns, which swept upwards and outwards in a bold curve, and were probably but little short of 10 feet in span.



CALLA BULL ($\frac{1}{2}$ nat. size).

THE GAUR (*Bos gaurus*).

With the magnificent animal known as the gaur, but generally misnamed by Indian sportsmen the bison, we come to the first of three species from South-Eastern Asia, nearly allied to one another, and broadly distinguished from those already noticed. These animals, which include the handsomest existing representatives of the genus, are collectively characterised by the following features. The horns are flattened to a greater or less degree from front to back, more especially at their bases, where they present an elliptical cross-section; this character being more strongly marked in the bulls than in the cows. The tail is shorter than in the typical oxen, and reaches but little if at all below the hocks. A third feature is presented by the distinct ridge running from the shoulders to the middle of the

back, where it ends in an abrupt drop, which may be as much as 5 inches in height. This ridge is caused by the great height of the spines of the vertebræ of the fore-part of the trunk as compared with those of the loins; but it is a character much less developed in the banting than in either of the other two species. The three species have also a characteristic coloration, the adult males being dark brown or nearly black, the females and young males being either paler or reddish brown, while in both sexes the legs from above the knees and hocks to



BULL GAUR ($\frac{1}{2}$ nat. size).

the hoofs are white or whitish. The hair is short, fine, and glossy, and the hoofs are narrow and pointed.

The gaur is a strong and massively-built species, easily recognised by the high convex ridge on the forehead between the horns, which bends forwards, and thus causes a deep hollow in the profile of the upper part of the head. The ridge on the back is very strongly marked, and there is no distinct dewlap on the throat and chest. The flattening of the horns at the base is very decided, and the horns are regularly curved throughout their length, and are bent inwards and slightly backwards at their tips. The ears are very large, the tail only just reaches the hocks, and in old bulls the hair becomes very thin on the back.

In colour the adult male gaur is dark brown, approaching black in very old

individuals; the upper part of the head, from above the eyes to the nape of the neck, is, however, ashy-grey, or occasionally dirty-white, the muzzle is pale-coloured, and the lower part of the legs pure white. The cows and young bulls are paler, and in some instances have a rufous tinge, which, according to Mr. Blanford, is most marked in individuals inhabiting dry and open districts. The colour of the horns is some shade of pale green or yellow throughout the greater part of their length, but the tips are black.

The gaur appears to be the tallest of all the oxen, old bulls sometimes reaching as much as 6 feet (18 hands) at the shoulder, or even, it is said, exceeding these dimensions by an inch or more. The more usual height is, however, from 5 feet 8 inches to 5 feet 10 inches; while the cows do not exceed 5 feet. Mr. Blanford gives the average size of the horns of bull gaur as from 20 to 24 inches along the outer curve; but specimens have been recorded with a length of 39 inches and a basal girth of 19 inches. This girth has, however, been exceeded by horns of which the length was less, a pair from the Malay Peninsula having a circumference of 22 inches, with a length of 32 inches. The horns of the cows are smaller, measuring in large examples from 23 to 24 inches above the curve, with a girth of about 13 inches.

Distribution. The geographical range of the gaur is extensive, comprising all the larger forest regions of India from Cape Comorin to the foot of the North-Eastern Himalaya, but excluding Ceylon. To the north-west its limits in India are marked, according to Mr. Blanford, by the valley of the Narbada River; while in the grass-jungles of the Ganges Valley the gaur is met with only along the skirts of the Himalaya. Eastwards the range of the gaur extends from Nipal through the hilly districts on the south of Assam into Burma, and thence as far south as the Malay Peninsula, where it is known to the natives as the *sladong*. It has been stated that the gaur occurs in Siam, but this requires confirmation.

Habits. The gaur prefers hilly districts to the plains, and in India is more generally found at elevations of from two thousand to five thousand feet than in the low country. While aged bulls are generally or invariably solitary in their habits, gaur, as a rule, collect together in small herds of about a dozen individuals, although the number may be increased to twenty or thirty, and one instance is recorded where the number in a herd was estimated at not less than one hundred head. Such an unusual gathering was, however, probably but temporary, and due to the scarcity of pasture. Each herd is governed by an old bull; the other members of that sex present being always younger animals. The best account of the habits of the gaur is by G. P. Sanderson, from whose work the following extracts are taken, with the substitution of the word gaur for bison.

The gaur living in herds "are shy and retiring in their habits, and retreat at once if intruded upon by man. They avoid the vicinity of his dwellings, and never visit patches of cultivation in the jungle. The gaur is thus an animal which would soon become extinct before the advance of civilisation were the latter rapid, or were the jungles in which he roams limited in extent; but his exemption from serious diminution, except in isolated positions, is secured by the existence of the continuous jungles of the Western Ghats and other forest ranges. Gaur, though

found in the low-country jungles, are very partial to high and well-wooded tracts, and their activity in hilly ground is astonishing. A herd scrambles up a steep hillside almost with the facility of a troop of deer, or thunders down a slope into the thicker cover of a valley, when alarmed, at a rapid trot or free gallop."

The food of the gaur, according to the same writer, consists mainly of grass, but also comprises the leaves and young shoots of bamboo, as well as the bark of certain trees. Gaur "feed till about nine in the morning, or later in cloudy and rainy weather; they then rest, lying down in bamboo-cover or light forest till the afternoon, when they rise to graze and drink; they also invariably lie down for some hours during the night. Although certainly quick in detecting an intruder, gaur can scarcely be considered naturally wary animals, as they seldom encounter alarms in their native haunts. Unsophisticated herds will frequently allow several shots to be fired at them before making off, and even then probably will not go far. But if subjected to frequent disturbance they quickly become as shy as deer, and if alarmed by the approach of man they retreat without loss of time." Except when wounded, and in such a position as to be unable to escape, Sanderson states that he has never known gaur belonging to a herd attack human beings. Gaur are very similar in their general habits to elephants, and herds of both may at times be found feeding in proximity. "Both seek the deep and ever-verdant valleys, watered by perennial streams, during the hot months, or from January to May, where they are safe from the jungle-fires which sweep the drier localities. With the early rains of April and May a plentiful crop of succulent young grass springs from beneath the black ashes, and the gaur and elephants then roam forth to feed and enjoy their emancipation from the thraldom of the season of scarcity. About September the grass in the hill-ranges has become so coarse, and the annoyance from insects during continued rain so great, that the herds move into more open country, and especially into forest tracts at the foot of hill-ranges where suitable cover exists." In such localities the grass is not more than a yard high at the most, and insects are comparatively few. In contradistinction to elephants, gaur never forsake the forest districts for the open plains; but when in the lowland districts are in the habit of visiting the numerous salt-licks.

It must be remembered that the foregoing description applies solely to the gaur of Southern India, and that in the more northern portions of their range, where the seasons are different, there is a corresponding alteration in their habits. When in the lowlands, gaur are apt to catch various diseases prevalent among domestic cattle, and sometimes the herds are decimated from this cause. In Peninsular India the calves are generally born during August and September, although a few are produced from April to June.

The cries of the gaur are three in number. The first is a loud reverberating bellow, used as a call; the second a low mooing cry, uttered when in alarm, or when the curiosity of the animals is excited; while the third is a kind of whistling snort, heard when the frightened creatures dash off into thicker cover. In India proper the gaur has never been domesticated; and it is but recently that a living example—a young one—has been exhibited alive in England. The hill-tribes of the north-eastern portion of India have, however, succeeded in taming these animals.

Solitary gaur are always very old bulls, which have been driven from the

herds by their younger rivals after deadly combats, the marks of which are to be seen on their scored and seamed flanks, as well as in their slit and frayed ears and their battered horns. Mr. Sanderson says that these solitary bulls always have the finest heads and horns, and offer the most noble object of pursuit to the sportsman. The morose and savage disposition commonly attributed to these outcasts is regarded by the same writer as not altogether authenticated. It is true, indeed, that men are sometimes killed by a sudden rush from one of these solitary bulls, but that this is generally owing to the circumstance that the animal has been suddenly surprised, and thereupon starts up and rushes forwards without considering what may be in its path.

Hunting. Gaur-shooting, from the nature of the ground, is invariably undertaken on foot, and, next to elephant-shooting, is considered to be the finest sport with the rifle in India. Good trackers are essential to its success; but these are fortunately to be found among the non-Aryan hill-tribes of Southern India, who are unsurpassed in the keenness and accuracy with which they follow a trail. The emergence of an old solitary bull-gaur on an open glade, among the tall bamboo forests of the hills of Southern India, is described as being one of the finest sights with which the toils of the sportsman can be rewarded. When killed, the gaur affords excellent meat, the great delicacy being the marrow-bones roasted on the camp fire.

THE GAYAL (*Bos frontalis*).

Well known for many years as existing in a semi-domesticated condition in the hilly districts of North-Eastern India, it is but recently that the gayal has been determined to be a truly wild species, although we have yet no definite information of its habits or the limits of its range in this condition.

The gayal, or, as it is frequently termed the mithan, is nearly allied to the gaur, from which, however, it differs in several important particulars. In the first place, it is a somewhat smaller animal, with proportionately shorter limbs, a minor development of the ridge on the back, and a larger dewlap on the throat of the bulls. The head is also shorter and broader, with a perfectly flat forehead and a straight line between the bases of the horns. The horns, which are very thick and massive, are less flattened and much less curved than in the gaur, extending almost directly outwards from the sides of the head, and curving somewhat upwards at the tips, but without any inward inclination. Their extremities are thus much farther apart than in the gaur. The colour is very nearly the same as in the latter, the head and body being blackish-brown in both sexes, and the lower portion of the limbs white or yellowish. The horns are of uniform blackish tint from base to tip. Some domesticated gayals are parti-coloured, while others are completely white.

The gayal stands much lower at the withers than the gaur. In the skull of an old wild bull measured by Mr. Blanford the horns reached 14 inches both in length and basal girth; but these dimensions are exceeded by those of many domesticated specimens. The cow gayal, as shown in our illustration, is a much smaller animal than the bull, and has scarcely any dewlap on the throat.

Distribution. It has been ascertained by Mr. Blanford that the gayal occurs in a wild condition in Tenasserim; but in a more or less domesticated condition large herds of these animals are kept by the Kuki tribes on the hill-districts of Tipperah. It is, moreover, certain that some of the domesticated cattle kept by the hill-tribes on both sides of the Assam Valley in the districts of Manipur, Cachar, Chittagong, and the Lushai Hills, are gayal, although others are



COW GAYALS ($\frac{1}{2}$ nat. size).

gaur. From indications afforded by certain skulls it is not improbable that these tame gayal and gaur occasionally interbreed. Mr. Blanford observes that the tame herds of gayal "are kept for food, and, according to some authorities, for their milk, though this is doubtful, as most of the Indo-Chinese tribes who keep mithans never drink milk. The animals appear to be never employed in agricultural labour, nor as beasts of burden. They roam and feed unattended through the forest during the day, and return to their owner's village at night."

Habits. Like the gaur, the gayal is essentially an inhabitant of hill-forests, and the facility with which it will traverse rocky country is little short of marvellous for an animal of such bulky proportions.

Gayal have been exhibited in England alive, but none of them were fully-grown bulls, and consequently failed to give an adequate idea of the magnificent proportions attained by that sex. Adult bulls have, however, been shown from time to time in the Zoological Gardens at Calcutta, and were most splendid animals, with glossy coats of the deepest shade of brown. Gayal will breed with the humped cattle of India, and the product of such a union born in the London Zoological Gardens was again crossed with a bull American bison. A pure-bred gayal calf produced in the same menagerie was of a light brownish red colour, with the throat, chest, and the inner sides of the legs white.

THE BANTING (*Bos sondaicus*).

The banting, or Javan ox, differs very considerably from both the preceding species, and serves to connect them with the typical oxen. The most distinctive feature of this ox is the large white patch on the hind-quarters, which extends upwards to the root of the tail, although not surrounding it. Another peculiarity of the banting is that the cow has the head, body, and upper portions of the limbs of the same reddish brown, almost chestnut colour as the calves. The general build of the animal is slighter than that of the gaur, the ridge on the back is much less developed, and the legs are proportionately longer. The head is also more elongated and pointed; while the horns, which are cylindrical in the young, are relatively smaller. In the adult bull they are flattened at the base, and are much curved, the direction being at first outwards and upwards, while towards the tips they incline inwards and somewhat backwards. The tail descends below the hocks; and the dewlap is of moderate size. The old bulls are black, with the exception of the white patch on the buttocks and the legs, from the knees and hocks downwards. The young calves, like those of the gayal, have the whole length of the outer surface of the limbs chestnut; and they are also distinguished by a dark streak down the back. A full-grown bull banting from Java measured 5 feet 9½ inches at the withers; but Mr. Blanford states that the largest example recorded from Burma was only 5 feet 4 inches in height.

Distribution. The banting is exclusively confined to the regions lying to the eastwards of the Bay of Bengal, occurring throughout Burma, and probably extending as far north as the hills to the eastwards of Chittagong, while it also inhabits the Malay Peninsula, and the islands of Java, Bali, Borneo, and probably Sumatra. That it also occurs in Siam is almost certain, but its exact range in the Indo-Chinese countries has still to be determined. Large herds of domesticated banting are kept by the Malays in Java, and also in the small island of Bali, lying to the south-east. The herds in Bali are replenished by importation from Java. The Malays speak of a wild ox under the name of the sapio, which may prove to be a variety of the banting with ferruginous red instead of white on the legs.

It has already been noticed that the original colour of the wild ox or aurochs

of Europe was probably white mixed with reddish brown; and the fact that the calves of all the three species of the present group are reddish brown points to the conclusion that this was the ancestral coloration. Now the fact that the female banting permanently retains this ancestral coloration, which is transient in the gaur and gayal, indicates that the present species is a less specialised form than either of the other two; the dark colour being acquired only in the male sex.



THE BANTING ($\frac{1}{2}$ nat. size).

This is confirmed by the structure of the banting, which departs less widely from that of the typical oxen than is the case with the other two species of this group.

Habits. Although the accounts of the habits of the banting are not very full, yet it appears that in these respects this animal is very similar to the gaur. Mr. Blanford suggests, however, that from its relatively longer legs the banting is less addicted to climbing among rocky hills than are either of the other members of the group, and that it is accordingly more restricted to the plains of tall grass. The domesticated race breeds freely with the Indian humped cattle.



DOMESTIC YAK.

It is stated by Blyth that in old bulls the skin between the bases of the horns becomes enormously thickened, and assumes a horny and rugged condition; this development beginning to take place before the coat has commenced to change from the light to the dark colour.

The extinct Etruscan ox (*B. etruscus*) from the Pliocene of the European continent, appears to have been allied to the banting, but with the horns placed low down on the skull near the eyes.

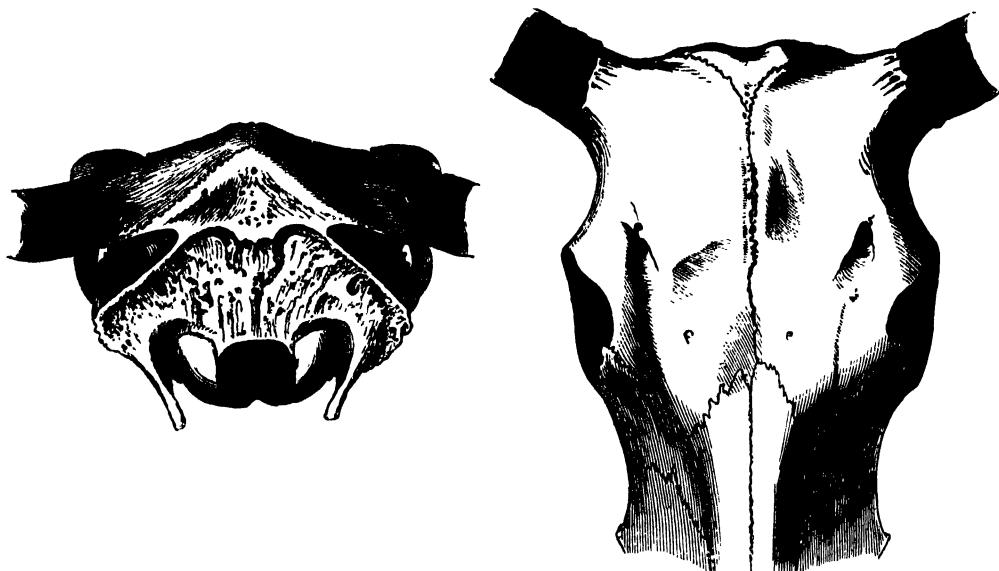
THE YAK (*Bos grunniens*).

The yak is one of the numerous mammals peculiar to the elevated plateau of Tibet, and differs markedly from all the other members of the ox tribe, although to a certain extent it forms a connecting link between the preceding group and the bisons. The most distinctive peculiarity of the yak, so far as external features are concerned, is the mass of long hair with which the flanks, limbs, and tail are clothed, and which makes the general appearance of the animal so very different from that of other oxen. On the head and upper-parts of the body the hair is short and nearly smooth, and the long hair only commences on the lower part of the sides where it forms a fringe of great depth, extending forwards across the shoulders and backwards on to the thighs. On the tail the long hair is developed on the lower half, where it expands into an enormous tuft which does not generally reach below the hocks. There is also a tuft of long hair on the breast. The colour of the hair is a uniform dark blackish brown, sometimes tending to a rusty tint on the flanks and back, and with a grey grizzle on the upper part of the head and neck in very old individuals. Around the muzzle there is a little white. We frequently find the yak represented as a brown and white, or even a pure white animal, but all such specimens are domesticated, and mostly hybrid individuals.

In build the yak is massively formed, with short and stout legs. The shoulders are high, but there is not the distinct ridge on the back characteristic of the gaur, and the whole back is nearly straight throughout, without any falling away at the hips. Both the ears and the muzzle are small; and the dewlap is totally wanting. The head is long and narrow, with a nearly flat forehead, and the eyes are approximated to the horns. The horns, which are very large in the bull, are smooth, and nearly or quite cylindrical, with the first curvature of their upper border concave, as in the gaur and banting. They curve at first upwards and outwards, then sweep boldly forwards, after which they incline upwards and inwards, and in some cases slightly backwards. The hoofs are relatively large and rounded. In height, it is stated that old bulls occasionally stand nearly 6 feet at the shoulder; but 5 feet 6 inches may be taken as the average. The weight of bulls is said to be about 1200 lbs. Average-sized horns vary in length from 25 to 30 inches measured along the curve; but a pair has been recorded measuring 40 inches in length, with a basal girth of nearly 19 inches. The horns of the cows are always smaller and thinner than those of bulls.

Such are the leading external characteristics of the yak; but there are also certain features connected with the skeleton which are worthy of notice. In the

first place, there are fourteen pairs of ribs, whereas, in all the oxen hitherto noticed, the number is but thirteen; and in this respect the yak resembles the bisons. In the skull, the region between the eyes and the occiput is relatively shorter and wider than in the typical oxen, and the horns are set on somewhat below the plane of the extreme summit. In consequence of this, the front view of a yak's skull exhibits a small prominence between the horns formed by a boss of bone at the top of the occiput; the crest or summit of the occiput itself being invisible from the front, and the shape of the whole occiput forming an inverted V. The difference in the shape of the occiput from that obtaining in the true oxen may be seen by comparing the accompanying figure with that of the skull of the Galla ox given on



FRONT AND BACK VIEWS OF THE SKULL OF DOMESTICATED YAK.—After Rütimeyer.

p. 173. In regard to the position of the horns and some other features of the skull, the yak approximates to the bisons.

Distribution. Yak, as we have said, inhabit the plateau of Tibet, probably extending northwards as far as the Kuen-Luen range, while eastwards they range into the Chinese province of Kansu, and westwards enter the eastern portions of Ladak, especially the regions in the neighbourhood of the Chang-Chenmo valley and the great Pangkong lake. The greater portion of the country comprised within this extensive area is desolate and dreary in the extreme, but yak confine themselves to the wildest and most inaccessible portions of these regions, and are found only at great elevations, ranging in summer from about fourteen thousand to upwards of twenty thousand feet, and perhaps even more, above the level of the sea. They are at all times extremely impatient of heat, and delight in cold.

Habits. Writing of the yak, General Kinloch observes that, "although so large a beast, it thrives upon the coarsest pasturage, and its usual food consists of a rough wiry grass, which grows in all the higher valleys of Tibet,

up to an elevation of nearly twenty thousand feet. On the banks of the streams in many places a more luxuriant grass is met with, and it is particularly plentiful in the valleys of Chang-Chenmo and Kyobrung, forming the attraction which entices the yak from the still wilder and more barren country further north. Yak seem to wander about a good deal. In summer the cows are generally to be found in herds varying in numbers from ten to one hundred; while the old bulls are for the most part solitary or in small parties of three or four. They feed at night and early in the morning, and usually betake themselves to some steep and barren hill-side during the day, lying sometimes for hours in the same spot. Old bulls in particular seem to rejoice in choosing a commanding situation for their resting-place, and their tracks may be found on the tops of the steepest hills, far above the highest traces of vegetation. The yak is not apparently a very sharp-sighted beast, but its sense of smell is extremely keen, and this is the chief danger to guard against in stalking it. In the high valleys of Tibet, where so many glens intersect one another, and where the temperature is continually changing, the wind is equally variable. It will sometimes shift to every point of the compass in the course of a few minutes, and the best-planned stalk may be utterly spoiled."

The yak found in the Chang-Chenmo valley are chiefly or entirely stragglers from Chinese territory, and, owing to incessant pursuit, very few are to be met with at the present day in these regions. Native travellers report, however, that on the upper Indus, to the eastward of Ladak, yak are to be found in vast numbers, and that there they do not exhibit the extreme wariness characterising those which wander into Ladak. In Northern Tibet yak have been also met with in great numbers by the Russian explorer, Prejewalski. Here the old bulls were found alone, and the cows and younger males generally in small herds; although, where the pasture was good, the herds were sometimes very large. These herds wandered more or less regularly over wide tracts of country, and, according to native reports, were found in summer in grassy plains, where they were quite unknown in winter. As in Southern Tibet, they were especially partial to the tracts bordering the streams, where grass was more abundant than elsewhere. On the other hand, the solitary bulls were reported to inhabit the same districts throughout the year. Where the herds were largest, their numbers are said to be reckoned by hundreds, and even thousands. When alarmed or expecting danger, the cows and older bulls place themselves in the van and on the flanks of the herds, with the calves in the centre; but on the near approach of a hunter, the whole herd will take to flight at a gallop, with their heads down and their tails in the air. A wounded yak, whether cow or bull, will, according to General Kinloch, not unfrequently charge.

A peculiarity of the yak is its grunting voice, from which it **Domestication.** derives its Latin title. Domestic yak are kept by the inhabitants of the higher regions of Tibet as beasts of burden, and for the sake of their flesh; and are absolutely essential for crossing many parts of that desolate region. Some of the pure-bred animals kept by the Tartar tribes, living on the Rupsu plateau, to the south of the Indus in Ladak, are magnificent beasts of large size and uniformly dark colour. When they have not been used for a considerable period they are

very wild, and apt to break loose and throw their loads; but after a few days' march they sober down. In other parts the yak are smaller, and vary greatly in colour, being sometimes entirely white, while the tail is very generally of that hue. There are also many crosses between the yak and ordinary cattle, some of the breeds being without horns. These half-breeds have the advantage of being able to withstand much higher temperatures than the pure yak; and they may be met with carrying burdens in the hot valley of the Indus, between the town of Leh and Kashmir.

Although yak are admirable beasts of burden on account of their endurance and strength, and the facility with which they will traverse glaciers and swim icy torrents, they have the great disadvantage that they will not eat corn. This frequently necessitates the pushing on of the party by forced marches to prevent their beasts from perishing of hunger. The following description of a march with yak, for the truthfulness of which the present writer can vouch from his own personal experience, is from the pen of General Macintyre. "For more than six weary hours," writes the general, "did we toil up against the almost blinding snow and piercing wind that chilled us to the very marrow, although the distance to the summit was only six or seven miles. It was truly wonderful to see the way in which the yaks struggled through the deep snow, and scrambled over places which were often difficult and sometimes dangerous to traverse. Nothing could have exceeded the powers of endurance evinced by these animals, which were game to the backbone, and as sure-footed as goats. One of them, notwithstanding, lost its footing on a steep slope of *névé*, and went rolling and sliding down until it was fortunately stopped by a friendly rock; otherwise it must have disappeared for ever under the glacier. On regaining its feet the creature merely shook itself, and on being disentangled from its load soon clambered up again."

All who have visited a Tibetan monastery, or lamasery, must have been struck with the number of yak-tails suspended as streamers from tall poles fixed in the ground before the entrance. The more general use of these appendages throughout the East is, however, in the form of *chowris*, or fly-whisks. For this purpose pure white tails are preferred; and they are frequently mounted with the twisted horn of a black-buck as a handle. In China yak-tails dyed red are affixed to the roofs of the summer residences as pendants.

THE EUROPEAN BISON (*Bos bonassus*).

The European bison, wisent, or zubr is one of two species representing a distinct and peculiar group of the genus *Bos*. These animals resemble the yak in their cylindrical horns and the relative shortness of the forehead of the skull, and also in the large number of their ribs, of which there may be fourteen or fifteen pairs. They differ, however, in having the horns placed more below the plane of the occipital region of the skull, so that in a front view the crest of the occiput itself is seen at the summit of the skull. A further distinctive feature is to be found in the extreme convexity of the forehead of the skull; while the sockets of the eyes are very prominent, and assume a tubular form. Moreover, the pre-maxillary bones, forming the extremity of the skull, are separated from the very

short nasal bones by a much longer interval than in the yak and the gaur; and are thus very widely different from those of the typical oxen, which are prolonged upwards to join the elongated nasals.

Bison are further characterised by the great excess in the height of the withers over the hind-quarters, owing to the great length of the spines of the vertebræ in the fore-part of the trunk, as displayed in the figure of the skeleton on p. 158. This produces a distinct hump on the shoulders, which passes, however, gradually into the line of the back without the sudden descent characterising the gaur. The great development of the fore-quarters appears to be intensified by the mass of dark brown hair with which the back of the head, neck, shoulders, and chest are covered, and which extends far down on the fore-limbs. The long hair is likewise continued as a kind of crest along the middle of the back nearly to the root of the tail; the tail itself being tufted at the end, and reaching some distance below the hocks. The remainder of the body is covered with short curly hair of a somewhat lighter tint than that clothing the fore-quarters. In summer the long hair over all the body is shed in large patches, thus showing the nearly bare skin clothed with short mouse-coloured hair, as exhibited in our coloured illustration. Both the European and the American bison are very closely allied, and we shall reserve our notice of their distinctive differences till we come to the second of the two species. Owing to a confusion of terms, the name aurochs, which properly belongs to the extinct wild ox of Europe, has been very generally applied to the European or true bison, but it may be hoped that this misapplication will soon be a thing of the past.

The European bison is a forest-dwelling animal, having been always absent from the open plains of Southern Russia, which in many respects resemble the habitat of its North American cousin. Formerly this species, as attested both by historical documents and by its semi-fossilised remains, was abundant over a large area of Europe, but it is now restricted to the forests of Bialowitza in Lithuania, to the Caucasus, and, it is said, to portions of Moldavia and Wallachia. Fossil remains of the bison are met with in the caverns and superficial deposits of England, France, Switzerland, Germany, and Italy; the earliest deposits in which they occur being the brick - earths of the Thames valley, where they are associated with those of the mammoth, and in the still older "forest-bed" of the Norfolk coast. The fossil race was, indeed, of larger dimensions, and had longer and rather straighter horns than its existing representative; but these differences cannot well be regarded as of specific importance. From Britain the bison disappeared at a much earlier date than the aurochs, none of its remains occurring in the fens and turbaries, where those of the latter are so common. Northwards the range of the bison formerly extended into Siberia; while its remains have also been obtained from the frozen soil of Eschcholtz Bay in Alaska.

The bison now living in Lithuania are specially protected by the **Habits.** Russian Government and are under the charge of a staff of keepers, but those of the Caucasus are thoroughly wild. Although living at a greater altitude, and thus exposed to a more intense cold, the bison of the Caucasus are less thickly haired than are those of Lithuania. Bison were abundant in the Black Forest in the

time of Julius Cæsar, and as late as the ninth and tenth centuries were sufficiently numerous in parts of Switzerland and Germany to be used as food. In a recent summary of the history of the species, Mr. F. A. Lucas states that "up to 1500 the European bison seems to have been common in Poland, where it was looked upon as royal game, and hunted in right royal manner by the king and nobility, as many as two thousand or three thousand beaters being employed to drive the game. In 1534 the animal was still so numerous in the vicinity of Girgau, Transylvania, that peasants passing through the woods were occasionally trampled to death by startled bison, and hunts were undertaken by the nobles in order to reduce the number of the animals. In spite of this local abundance, it is probable that about this time the bison was in a great measure restricted to Lithuania; and although so late as 1555 one was killed in Prussia, it is almost certain that this was merely a straggler from the main herd. In 1752 a grand hunt was organised by the Polish king, Augustus III., and in one day 60 bison were killed. . . . For some time after the above event little seems to have been recorded concerning the zubr, so that Desmarest, writing in 1822, says that if any remain in Lithuania they must be very few in number. There were, however, over 500 bison in Lithuania at that time, for in 1820 there were that number, this being a considerable increase since 1815, when there were estimated to be only 300. About this time active measures must have been taken for the protection of the Lithuanian herd, for in 1830 it comprised over 700 individuals. In 1831 a local revolt occurred, the game laws were set at naught, and the number of bison reduced to 637. Order having been restored, the bison began to recuperate, and according to the official enumeration at the end of each decade, there were in 1840, 780; in 1850, 1390; and in 1860, 1700. Political troubles were, however, the bane of the bison, and just as the prosperity of the Lithuanian herd seemed assured, the Polish uprising of 1863 took place. Many bands of insurgents sought refuge in the forests; the bison were left to take care of themselves, and were so rapidly killed off that the next official count showed only 847. For a short time after peace was restored the herd increased to a slight extent, but later on it began to decrease, the enumeration of 1880 showing but 600, a number that has since been lessened, the herd being still on the wane." The herd is divided into about a dozen distinct bands, inhabiting different regions of the forest. In the Caucasus the bison is protected by the rugged nature of the country, as well as by special laws. Recently an English sportsman—Mr. Littledale—has been bison-shooting in the Caucasus, and a male and female which fell to his rifle are now exhibited in the British Museum.

The European bison, so far as can now be ascertained, appears to have always associated in small bands. In Lithuania these bands comprise from fifteen to twenty individuals during the summer, but in winter two or more of them unite to form a herd of from thirty to forty head. The very old bulls are solitary. In spring and summer the bison seek the thickest and deepest portions of the forest, but during winter frequent drier and more elevated cover. Whereas the nutriment of the American species consists wholly of grass, the European bison feeds largely upon the leaves, twigs, and bark of trees. Although active during both day and night, bison feed chiefly during the morning and evening. Large

trees are stripped of their foliage and bark as high up as the animals can reach, while smaller ones are broken down or uprooted.

In spite of their size and bulk, bison are active animals, and can both trot and gallop with considerable speed. In galloping the head is carried close to the ground and the tail high in the air. Generally they are shy and retiring in disposition, more especially when young; but in the Lithuanian forest an old bull has been known to take possession of a road and challenge all comers. During the breeding-season, which takes place in August or the early part of September, the bison are in the best condition. At such seasons the bulls engage in terrific conflicts, which occasionally end fatally, for the leadership of the herd. These combats are at first entered upon somewhat playfully, but soon take place in earnest, when scenes like the one depicted in our coloured illustration may be witnessed. The old solitary bulls then return to the herds, and after having either driven away or killed their younger rivals, once more resume the leadership. Not only are the younger bulls sometimes killed in these conflicts, but the same fate occasionally overtakes the cows. At the conclusion of the breeding-season the old bulls revert to their solitary life. The calves are born in May or the early part of June, and are dropped in the most secluded parts of the forest. The cows apparently do not calve more frequently than once in three years, so that the rate of increase is necessarily slow. In defending their offspring against the attacks of bears and wolves, the females display great courage, and seldom allow them to be carried off except at the sacrifice of their own lives. Occasionally when full-grown bulls get half-buried in deep snow they are pulled down by wolves.

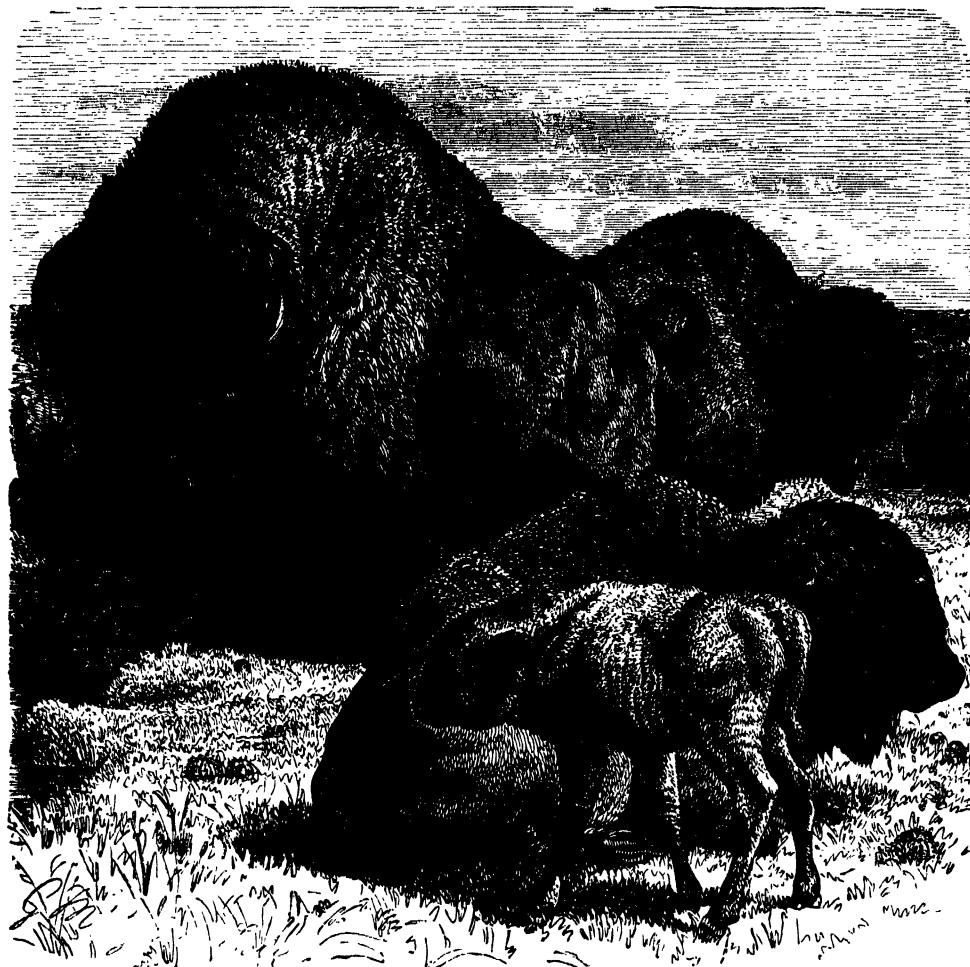
THE AMERICAN BISON (*Bos americanus*).

As the gaur in India has usurped the name of bison, while the European bison has been frequently called the aurochs, so the American bison in its native country is almost invariably misnamed the buffalo.

The American bison, which is now, unfortunately, practically exterminated, differs from its European cousin not only in certain structural features, but likewise in habits, being essentially an inhabitant of the open plains, where it formerly congregated in vast herds, comprising thousands of individuals, and living entirely on grass. According to Mr. Hornaday, to whom we are indebted for a full account of the species, the American bison differs from the European kind in the following features. Firstly, the mass of hair on the head, neck, and fore-quarters is much longer and more luxuriant, and thus gives the animal the appearance of possessing greater size than is really the case. As a matter of fact, the American species is lower, and has a smaller pelvis and less powerful hind-quarters than its European cousin, although its body is, on the whole, more massively built. Moreover, the horns are shorter and more curved, while the front of the head is more convex, and the sockets of the eyes less tubular. The tail is shorter and less bushy. An unusually fine bull American bison measured 5 feet 8 inches at the withers, but the average is considerably below this.

Mr. Hornaday regards this species as the finest and most striking in appearance of all the oxen, and remarks that "the magnificent dark-brown frontlet and beard,

the shaggy coat of hair upon the neck, hump, and shoulders, terminating at the knees in a thick mass of luxuriant black locks, to say nothing of the dense coat of finer fur on the body and hind-quarters, give to our species not only an apparent height equal to that of the gaur, but a grandeur and nobility of presence which are beyond all comparison among ruminants." Good horns measure from 16 to 17



AMERICAN BISON ($\frac{1}{7}$ nat. size).

inches, but a pair with a length of $20\frac{1}{8}$ inches and a girth of 15 inches have been recorded.

Distribution. The range of the American bison originally extended over about one-third of North America. "Starting almost at tide-water on the Atlantic coast," writes Mr. Hornaday, "it extended westward through a vast tract of dense forest, across the Alleghany Mountain system to the prairies along the Mississippi, and southward to the delta of that great system. Although the great plain country of the West was the natural home of the species, where it flourished most abundantly, it also wandered south across Texas to the burning plains of

North-Eastern Mexico, westward across the Rocky Mountains into New Mexico, Utah, and Idaho, and northward across a vast treeless waste to the bleak and inhospitable shores of the Great Slave Lake itself." Its maximum development was probably reached about a century and a half ago, when the greater part of North America was practically an unknown country so far as Europeans are concerned. And Mr. Hornaday is of opinion that, if left to itself, the bison would have crossed the Sierra Nevada and coast-ranges to reach the Pacific slopes; while it would ultimately have developed into several distinct races according to the climate of the different regions it inhabited. An example of the formation of such a race is afforded, indeed, by the variety known in the States as the mountain, or wood, buffalo. The gradual opening up of the interior of North America, with the advance of civilisation, soon, however, put an effectual stop to further increase of the species, and eventually led to its practical extermination.

Numbers and Extermination. In regard to its former numerical abundance, Mr. Hornaday¹ observes that "of all the quadrupeds that have ever lived upon the earth, probably no other species has ever marshalled such innumerable hosts as those of the American bison. It would have been as easy to count or to estimate the number of leaves in a forest as to calculate the number of bison living at any given time during the history of the species previous to 1870. Even in South Central Africa, which has been exceedingly prolific in great herds of game, it is probable that all its quadrupeds taken together on an equal area would never have more than equalled the total number of buffalo in this country forty years ago." As an instance of these enormous numbers, it appears that, in the early part of the year 1871, Col. Dodge, when passing through the great herd on the Arkansas, and reckoning that there were some fifteen or twenty individuals to the acre, states from his own observation that it was not less than twenty-five miles wide and fifty miles deep. This, however, was the last of the great herds; and Mr. Hornaday estimates that the number of individuals comprising it could not be reckoned at less than four millions. Many writers at and about the date mentioned speak of the plains being absolutely black with bison as far as the eye could reach; and Mr. W. Blackmore tells of passing through a herd for a distance of upwards of one hundred and twenty miles right on end, in travelling on the Kansas Pacific Railroad. Frequently, indeed, trains on that line were derailed in attempting to pass through herds of bison, until the drivers learned it was advisable to bring their engines to a standstill when they found the line blocked in this manner.

Col. Dodge, writing of his experiences on the Arkansas alluded to above, observes that "the whole country appeared one great mass of bison, moving slowly to the northward; and it was only when actually among them that it could be ascertained that the apparently solid mass was an agglomeration of numerous small herds, of from fifty to two hundred animals, separated from the surrounding herds by greater or less space, but still separated. The bison on the hills, seeing an unusual object in their rear, started at full speed directly towards me, stampeding and bringing with them the numberless herds through which they passed, and pouring down upon all the herds, no longer separated, but one immense compact mass of plunging animals."

¹ When quoting from Mr. Hornaday and other writers we have substituted the word bison for buffalo.

Many similar accounts attesting the vast swarms of bison which formerly roamed the prairies might be quoted, but the foregoing are sufficient for our purpose. Evidence of the numbers of these animals is still to be seen in the huge stacks of skulls piled up at many of the railway stations in the States awaiting transport.

The main cause which led to the extirpation of the bison was the advance of railways. With the progress of civilisation the bison was, indeed, foredoomed to



HEAD OF AMERICAN BISON.

disappear; but its end was hastened by the reckless way in which the unfortunate animals were shot for the sake of their hides or tongues; by the want of protective legislation on the part of the Government: by the preference for the flesh and skin of cows, by the marvellous stupidity and indifference to man of the animals themselves, and by the perfection of modern firearms.

It appears that although the bison had for more than a century been subject to a merciless persecution, both by Indians and Whites, yet up to the year 1830, beyond a certain restriction in its area of distribution, this desultory warfare had not made any very serious inroads on the numbers of the animals; and that as late

as 1870 there were certainly several million head still living. During the period from 1730 to 1830 the desultory warfare had, however, completely driven away the bison from the eastern portion of the United States, and also from the districts to the westward of the Rocky Mountains, where they were never very numerous. With the year 1830, Mr. Hornaday considers, began the era of the systematic slaughter of the bison for the sake of its flesh and hides; and the ever-increasing demand for "buffalo-robés," as the dressed skins are termed, soon began to tell on its numbers. Up to the year 1869 the bison occupied one large and continuous area; but the completion in that year of the Union Pacific Railway cut this area in twain, and at the same time divided the great herd into a northern and southern moiety. The headquarters of the southern herd were somewhere about the situation where Garden City, Kansas, now stands. Although the area occupied by this herd was greatly inferior in size to that of the northern herd, yet the number of bison on it was vastly greater, being estimated in 1871 as at least three, and probably nearly four, millions. That year saw the completion of the Kansas branch of the Union Pacific, and the great slaughter which thereupon commenced attained its height in 1873. At the latter date the destruction of these animals was so wasteful and so wanton that it is believed every hide which came into the market represented four individuals killed. The destruction was of course greatest along the lines of railways, and on one of the three railways penetrating the southern bison-country, nearly a quarter of a million skins, more than a million and a half pounds of meat, and fully two and a quarter millions of pounds of bones, were carried during the year in question. At this time the whole country was poisoned with the effluvia from the decaying carcases; and it was a common practice to drive away the animals when they came to drink till they became so maddened with thirst that they would come within easy shooting distance. Mr. Hornaday states that it is probably a safe estimate to say that not "fewer than fifty thousand bison have been killed for their tongues alone, and the most of these are undoubtedly chargeable against white men, who ought to have known better." Over three and a half million individuals are estimated to have been slaughtered in the southern herd between 1872 and 1874. In the latter year the hunters became alarmed at the great diminution in the number of the bison, and by the end of 1875 the great southern herd had ceased to exist as a body. The main body of the survivors, some ten thousand strong, fled into the wilder parts of Texas, where they had been gradually shot down, till a few years ago some two or three score remained as the sole survivors of the three or four millions of the great southern herd; and in the year 1880 bison-shooting was finally abandoned, as being no longer a profitable trade.

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With regard to the northern herd, of which the number in 1870 was approximately estimated at a million and a half, distributed over a very wide tract of country, it appears that the portion living in British North America was the first to be exterminated. Before the year 1880 the numbers of the herd had been greatly reduced in Dakota and Wyoming by the Sioux Indians; but the commencement of the final destruction was heralded by the opening in that year of the Northern Pacific Railway, which traversed the heart of the bison-country. The herd was, indeed, hemmed in on three sides by Sioux armed with breech-loading

rifles; and the price of robes having risen greatly in 1881, a rush from all sides was made on the devoted herd, and in the hunting-season, commencing in October 1882 and terminating in the following February, the annihilation of the great northern herd was practically completed; only some straggling bands, numbering a few thousands, surviving. This event appears to have come like a thunder-clap on the hunters, who actually fitted out expeditions in the autumn of 1884, only to find that their quarry had disappeared for ever. Mr. Hornaday states that to the south of the Northern Pacific Railway, a band of about three hundred settled permanently in and around the Yellowstone National Park, but in a very short time every animal outside of the protected limits of the park was killed; and whenever any of the park buffaloes strayed beyond the boundary, they too were promptly killed for their heads and hides. Those remaining in the Yellowstone are now protected by Government, and there are a few scattered bands still lingering in the more remote and inaccessible portions of the country, but otherwise the American bison has ceased to exist as a wild animal.

Turning to the development and habits of the species, it appears

Habits. that the breeding-season is from the beginning of July to the end of September, and that the calves are generally born from April to June, although occasionally as late as August. The cow does not breed till three years old, and sometimes produces two calves at a birth. For the first two months of its existence the calf has the pelage of a brownish yellow colour; and even at that period has indications of the long hair covering the fore-quarters of the adult. Young calves can be tamed with facility. In yearling bison the horns are in the form of a straight conical spike, of from 4 to 6 inches in length; and these spike-like horns, with a curve at the base in older individuals, continue till the end of the fourth year, during which period the young males are termed "spike-bulls." In these young bulls the horns are jet-black; but from scaling of the exterior, and the accumulation of dirt, they tend to grey in the adult. With advancing age the outer layers of the horn begin to break off near the summit, until the whole horn becomes short, thick, and blunted, "with only the tip of what was once a neat and shapely horn showing at the end. The bull is then known as a 'stub-horn,' and his horns increase in roughness and unsightliness as he grows older."

Towards the end of winter the coat of the bison assumes a faded and bleached appearance from the effects of the wear and tear of the elements; and towards the end of February, or somewhat later, the coat begins to change, but the whole process occupies more than half the year. The shedding is accomplished both by the new hair growing into and forcing off the old, and also by the latter falling off and leaving the skin bare in great patches, as shown in our coloured illustration of the European species. During the shedding process the animal presents an unsightly appearance, but by the end of June the whole of the old hair has fallen off and the body is bare, although the new dark hair is well grown on the head. During the summer the naked skin is scorched by the sun and bitten by flies, and the animal consequently protects itself by wallowing, and thus coating itself with a plaster of dried mud. By the beginning of October the new coat of hair has, however, attained a considerable length, and between the 20th of November and the 20th of December the bison is in the full glory of his apparel; and the contrast

presented by his condition at this time to that during the summer must be seen to be fully appreciated. The height attained by the bull bison has been already mentioned. In regard to weight, Mr. Hornaday states that an adult bull shot by his party scaled 1727 lbs., but as the animal was by no means fat it is probable that this weight is in some cases exceeded.

It was during the breeding-season that the small bands which had been previously distributed over a wide area of country collected in the huge herds above alluded to; and at such seasons the bulls were occupied either in chasing the cows or in combats among themselves. The concerted roaring of the bulls at these times is described as resembling thunder, and audible at distances of from one to three miles, or even, exceptionally, at five miles. At the conclusion of the breeding-season the herd again broke up into small bands. In these periodical journeys across the country in search of water regular tracks were formed by the bison, and as the water was approached several tracks united, with the result that in some places tracks of about twelve inches in width, and from six to seven in depth, may be seen following the level of the valleys; the bison in these journeys having always marched in single file. These old bison-tracks still remain as a memento of a vanished race, and are now used by the domestic cattle which have supplanted the monarchs of the prairie. After reaching the watering-place, the herd, instead of returning to its original feeding-ground, would wander right and left in search of fresh pastures. When undisturbed in good pasture, bison were always in the habit of lying down for a few hours during the middle of the day; and they were at certain seasons fond of rolling either in dust or mud. In districts where salt lakes occurred, the bison would resort to them in great numbers. All the great herds were in the habit of moving southwards for a distance of from two hundred to four hundred miles with the approach of winter; and during such journeys it frequently happened that numbers were lost in crossing quicksands, alkali-bogs, muddy fords, or on treacherous ice. It is stated that in 1867 upwards of two thousand bison out of a herd of four thousand were lost in a quicksand; and that an entire herd of about one hundred head perished when crossing the ice on a lake in Minnesota.

Bison would boldly face the cutting blizzards of the north-west, instead of turning tail to them after the manner of domestic cattle; although they would at the same time seek such shelter as might be obtainable by retiring to the ravines and valleys. In heavy falls of snow, which lay long on the ground, the bison were often compelled to fast for days, or even weeks, together; but they suffered most when the surface of the snow was covered with a thin crust of ice after a slight thaw, as their ponderous weight would drive their feet deep into the snow, and leave them at the mercy of the Indians, by whom they were slain by hundreds when thus helpless.

Hunting. Space does not admit of anything more than bare mention of a few of the modes in which the bison was hunted. The method of stalking, or "still-hunting," where the hunter creeps up to a herd and shoots one after another of its members, appears to be one of the most deadly, owing to the crass stupidity of the animals themselves. The plan adopted was first to shoot the leader, when the remainder of the herd would come and stupidly smell round the

body, till another animal assumed the post of leader, and was shot down when it was about to make a move; the same process being repeated almost without end. Riding down, surrounding, impounding, or hunting in snow-shoes were, however, other equally effective methods of destruction.

In captivity the American bison breeds freely, not only with its **Domestication.** own kind, but also with other species of cattle. In the United States a herd has been established by crossing bull bison with domestic cows; the cow bison not producing a hybrid offspring. This hybrid race is perfectly fertile, either with itself or when again crossed with domestic cattle; and it is considered that a strain of bison-blood will lead to the cattle in the North-Western States being better enabled to withstand the blizzards of those districts.

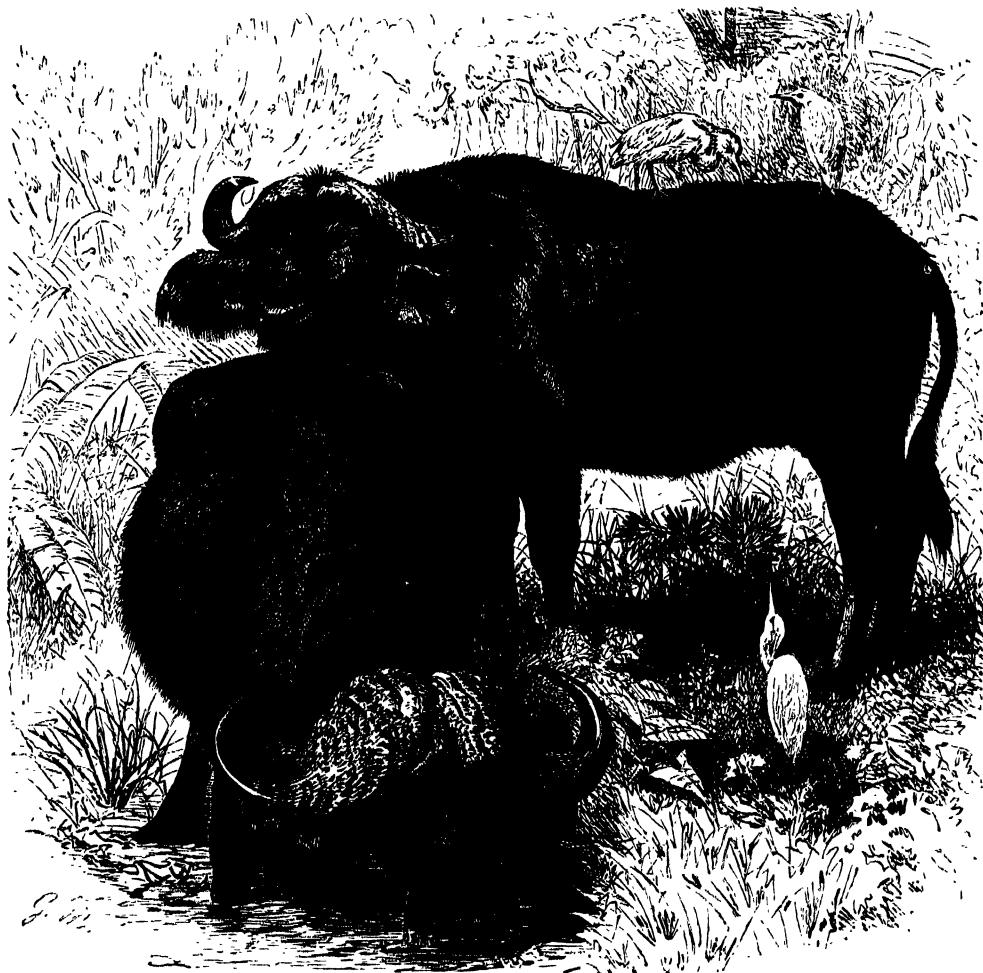
Extinct Bison. Subfossil remains of the American bison are found in various parts of North America, while in Texas there occur those of the extinct broad-fronted bison (*B. latifrons*), distinguished by its superior size, and its stouter and less backwardly-inclined horns.

THE CAPE BUFFALO (*Bos caffer*).

The Cape buffalo is our first representative of a group of oxen distinguished by several well-marked characters. They are all heavily-built animals, with thick and strong limbs, moderately long tails, tufted at the end, short necks, very broad muzzles, and large ears. The hair covering the body is always thin, and in old age leaves the skin almost entirely naked. The horns, which are generally large and massive, are more or less distinctly flattened and angulated, at least at the base, where their cross-section is triangular. They are placed on the skull a considerable distance below the plane of the occiput; and their upper border is concave, with the tips curved inwards, the curvature being generally at first outwards and backwards, and then outwards and upwards. In the skull the forehead is more or less markedly concave, and the premaxillary bones reach upwards to join the nasals, as in the typical oxen. The number of ribs is thirteen pairs.

The Cape, or black African buffalo is the largest and fiercest member of the group found in the continent, from which it takes its name. This species is characterised by its blackish colour, and the great massiveness of the relatively short horns, which are much flattened at the base, where they are expanded, so as to form in old bulls a kind of helmet-like mass, covering the whole of the upper part of the head, and with only a narrow line between them. From this expanded base the curvature of the horns is at first outwards, downwards, and backwards, and then forwards, upwards, and inwards; their smooth extremities being nearly cylindrical. The skull is characterised by its shortness, and also by the deep concavity of the profile below the horns; the nasal bones being extremely short, and the sockets of the eyes not particularly prominent. The head has a very large and expanded muzzle, and a characteristic hollow below the inner angle of the eye. The enormous flapping ears are thickly fringed on their lower border with hair; their upper border being sharply truncated before the descent to the pointed extremity. With the exception of the ears and the tip of the tail, the hair is very

sparse, and it is only on the head and limbs that old bulls can properly be said to be haired at all. In the cows and young bulls the hair is, however, thicker; and its colour in these is dark brown, with a more or less marked reddish tinge. A well-grown bull buffalo will stand between 4 feet 7 inches and 4 feet 8 inches at the shoulder. The horns vary in shape with the age of the animal. In regard to their size, Mr. Selous states that the largest pair he obtained had an extreme span,



CAPE BUFFALO ($\frac{1}{2}$, nat. size).

from bend to bend, in a straight line, of 3 feet 8 inches, with a depth on the forehead of 15 inches; the total length of each horn along the curve being 3 feet. In another example the same three dimensions were respectively 3 feet 6 inches, 17 inches, and 2 feet 11 inches.

Habits. The typical Cape buffalo is usually found in reedy swamps from the Cape as far north as the Equator; but some individuals distinguished, according to the Hon. W. H. Drummond, by their blacker hair and more spreading horns inhabit forests. From the Equator northwards to Abyssinia the

species is represented by a variety of lighter build, and with horns less thickened on the forehead, and separated in the middle line by a considerable interval. This variety was formerly regarded as indicating a distinct species, under the names of *B. aequinoctialis* and *B. centralis*; but intermediate gradations connect it so closely with the ordinary Cape form that this view has been abandoned.

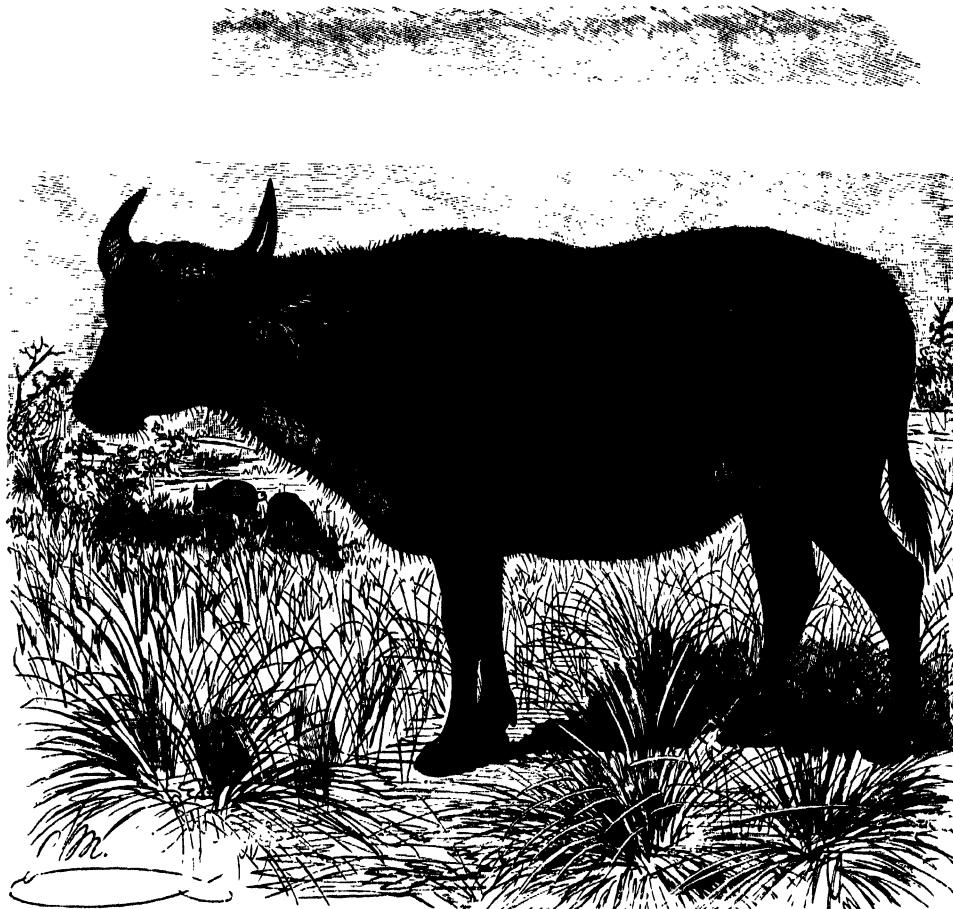
In regions where their numbers have not been thinned by the sportsman's rifle, the Cape buffalo, according to Mr. Selous, is usually found in herds of from fifty to two hundred, or even three hundred, individuals. Old bulls are frequently met with alone, although they more usually associate in parties of two, three, or four, while occasionally from eight to ten may be seen together. These small parties of bulls are said to be much less wary, and, consequently, much more easy to approach than large herds of cows; and solitary bulls are not regarded by Mr. Selous as more dangerous than other members of the species. The same writer observes that for animals of such heavy build and bulk these buffaloes are remarkably swift; and it requires a good horse to keep ahead of a charging buffalo even in the open; while in cover, unless very fleet, the horse stands a good chance of being overtaken. Cape buffaloes are commonly represented in pictures as charging with their heads lowered to the ground and their tails raised high in the air. This, however, according to Mr. Selous, is wholly incorrect, since, when charging, they "invariably hold their noses straight out, and lay their horns back over their shoulders. They lower their heads just as they strike."

Mr. Drummond writes of the habits of this species as follows:—"About sunrise they drink a sufficient quantity of water to last during the long, hot day, and then make their way to wherever they may have determined to sleep. This in summer is generally on the highest and most breezy spot to be found, under the shelter of two or three trees; in winter, in the thick jungle. They do not live farther from water than possible, as the moment the sun goes down, often before, they go straight to refresh themselves with a bath and drink before feeding, which they continue to do till soon after midnight, making the most horrible maze of track imaginable. They then rest and chew the cud for some time, getting up and continuing grazing until it is time to revisit the river or hole, and so onward to their lair."

The Cape buffalo breeds during the African summer, the young being born from January to March, and there being apparently never more than one at a birth. The calf is hidden in long grass; and for about ten days after its birth the cow separates from the herd, and remains within a short distance of her offspring, which she visits at intervals. In regard to the age to which the animal lives, Mr. Drummond states that old, solitary bulls have been known as such for twelve years, and he considers it probable that the full age may be about thirty years.

The buffalo has but two enemies—the lion and man; and the combined assaults of these two have in some districts so reduced its numbers that, according to Mr. Drummond, writing as far back as 1875, where there were formerly herds of from ten to one hundred in number, not ten head are to be found. A combat between three lions and a bull buffalo has been mentioned in our notice of the lion. The bulls frequently engage in fights between themselves; and Mr.

Drummond gives the following account of one such combat which he had the good fortune to witness:—"On looking through the edge of the last thicket which concealed them I saw two buffalo bulls standing facing each other with lowered heads, and, as I sat down to watch, they rushed together with all their force, producing the loud crash I had before heard. Once their horns were interlocked, they kept them so, their straining quarters telling that each was doing his best to force the other backwards. Several long white marks on their necks showed



SHORT-HORNED BUFFALO, SIERRA LEONE VARIETY ($\frac{1}{10}$ nat. size).

where they had received scratches, and blood dripping down the withers of the one next me proved that he had received a more severe wound. It was a magnificent sight to see the enormous animals, every muscle at its fullest tension, striving for the mastery. Soon one, a very large and old bull, began to yield a little, going backwards step by step, but at last, as if determined to conquer or die, it dropped on its knees. The other, disengaging his horns for a second, so as to gain an impetus, again rushed at him, but did not strike him on the forehead, but on the neck, under the hump, and I could see that with a twist of his horns he inflicted a severe wound." Instead, however, of following up his advantage, this

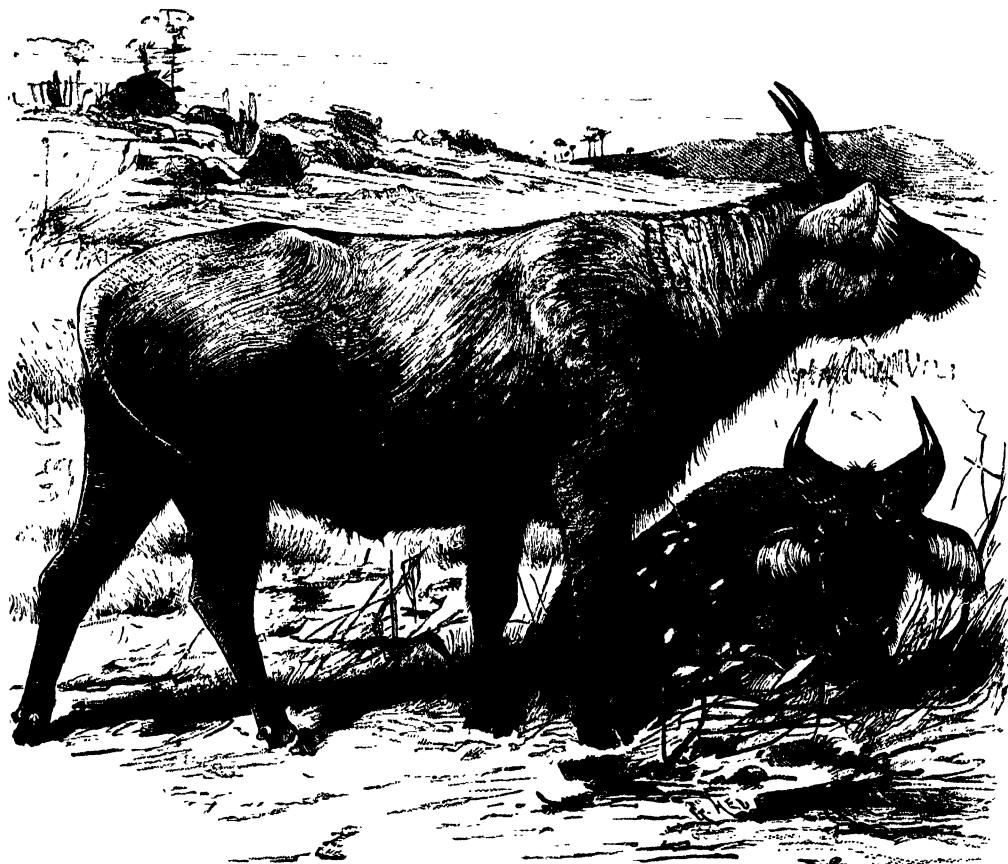
bull recoiled and hesitated, and was eventually charged by his adversary full in the shoulder, after which he declined to continue the contest.

The Cape buffalo has been described as the most dangerous of all South African animals, but both Mr. Drummond and Mr. Selous deny that this is really the case. It is true that more fatal accidents occur in buffalo-shooting than in any other sport, but this is discounted by the circumstance that more of these animals are killed than any other large game. Although there are exceptions, buffalo do not generally charge unless wounded; but cows with calves, or individuals wounded by lions are more irritable, and more prone to charge than ordinary. At the same time, the pursuit is far from being unaccompanied by danger; and Sir J. Willoughby states that of all the animals met with by him in Eastern Africa "the buffalo is probably the most cunning and dangerous to attack; they become very savage when wounded, and usually take to the thick bush, where they lie in wait for their foe. The greatest care should be taken in following them up, as, on account of the denseness of the bush, it is next to impossible for the hunter to avoid the sudden charge that is almost sure to ensue if the buffalo sights him first. A cow can be killed by a bullet anywhere on the forehead or behind the ear; but a bull is practically invulnerable in the head, although it may be dropped by a lucky shot striking above the eyes in the narrow line of division between the horns."

THE SHORT-HORNED BUFFALO (*Bos pumilus*).

The short-horned, or red buffalo, of which one variety is represented in the figure on p. 201, and a second in the accompanying illustration, is a smaller animal than the Cape species, from which it is further distinguished by its smaller and much less massive horns, as well as by its more abundant and lighter-coloured hair. This buffalo is a West African species, and is known to the natives as the niari, and to the Europeans of the west-coast as the bush-cow. It is found in most of the tropical regions where the Cape buffalo is unknown, and is essentially a forest-dwelling animal. The height of the animal is, as a rule, inferior to that of the Cape buffalo. The colour of the hair is generally some shade of yellow or red, but more rarely brown, although some individuals are much darker and nearly black. The specimen figured in the illustration on p. 201, which came from Sierra Leone, and was exhibited in the Zoological Gardens at Antwerp, in 1875, was light yellow above but reddish on the under-parts, with a sharp line of demarcation between the two areas. It will be observed from the figure that the horns are but little flattened, and are separated from one another by a wide interval on the forehead, and have a simple curvature; these features being apparently distinctive of all the specimens from the north-western portion of the creature's range. On the other hand, when we pass southwards into the Congo district, we find that these buffaloes, as shown in our second illustration, have the horns much more flattened and expanded at their bases, where they are closely approximated in the middle line. Their tips are also curved sharply upwards and inwards, terminating in a point. This variety, which is also of rather larger size than the other, was described as *B. centralis*, and approximates to the northern variety of the Cape buffalo.

Indeed with some of the specimens from Central Equatorial Africa it is difficult to find constant characters by which they can be distinguished on the one hand from the typical niari, with widely-separated and slightly-flattened horns, and on the other from the northern variety of the Cape buffalo. Hence it is probable that the present species is in reality nothing more than a geographical race of the latter, reduced in size and otherwise modified by the difference in its habitat. We have indications of the commencement of such a modification in the case of the "wood-bison" of North America, and there is no reason why such modifications



SHORT-HORNED BUFFALO, CONGO VARIETY ($\frac{1}{20}$ nat. size).

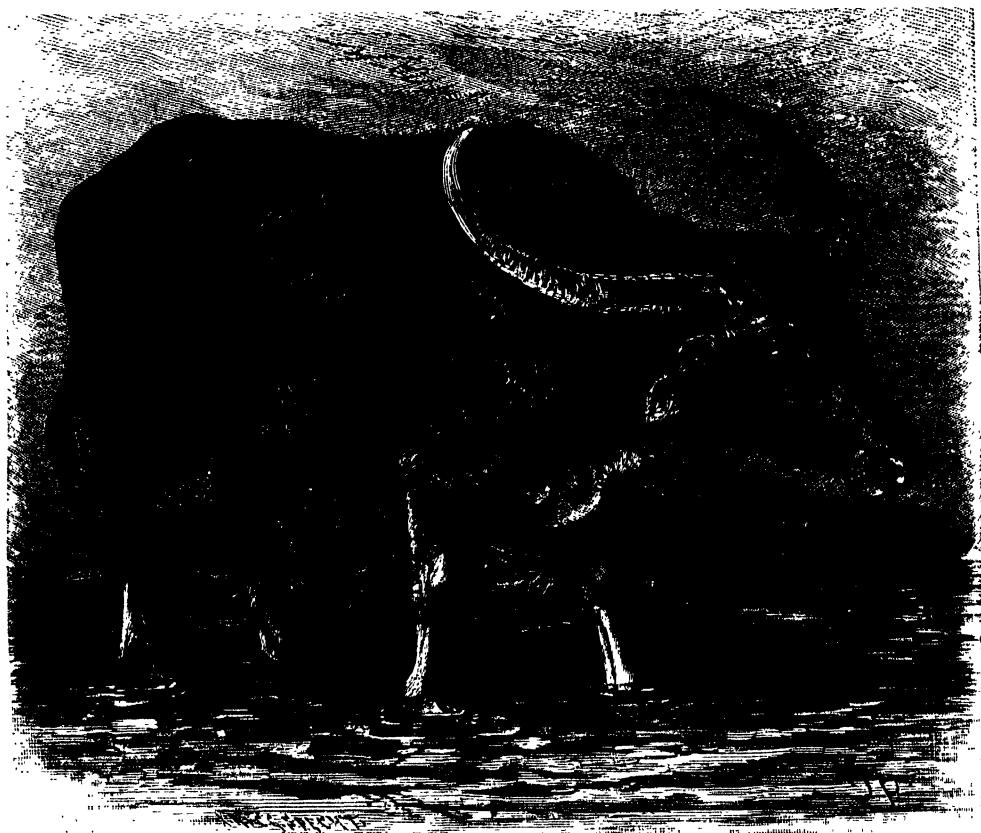
should not have been carried still further in the present instance. Horns of the typical short-horned buffalo range from 11 to 21 inches in length, with a basal girth of from 10 to 13 inches. The short-horned buffalo is found both in the plains and in the mountains of Western Africa, and appears to be far from uncommon. It possesses a speed almost equal to that of the larger antelopes; and when in thick cover is very difficult to drive out, except with the aid of dogs. Otherwise there does not appear to be anything specially noteworthy in its habits.

Extinct Forms. It may be mentioned here that both in Algeria and at the Cape there are found in the superficial deposits skulls of buffaloes allied to

the Cape species, but with far longer horns, which did not, however, meet in a helmet-like mass on the forehead. In an Algerian specimen the length of the bony horn-cores measured along the curve is fully 11 feet, while in one from the Cape the length is estimated at upwards of 14 feet. When covered with their horny sheaths, the horns would of course be still longer.

THE INDIAN BUFFALO (*Bos bubalus*).

The Indian buffalo, or arna, as the male is called in India, is a very different animal in appearance from either of the African species. It is characterised by the



THE INDIAN BUFFALO, FERAL RACE ($\frac{1}{2}$ nat. size).

much greater proportionate length of the head, of which the profile is nearly straight and the centre of the forehead markedly convex. In the skull the sockets of the eyes are very prominent, and the nasal bones are of much greater length than in the African species. The ears are also much smaller and less open, with only a very slight fringe of hair on their edges. Still more distinctive are the horns, which are very long, much flattened, and angulated throughout the greater part of their length, with strongly-marked transverse wrinkles, and a

distinctly triangular section. They taper gradually from root to tip, and generally curve regularly upwards, outwards, and a little backwards from the line of the face in nearly a single plane; the tips bending inwards and slightly forwards. This is the type represented in our illustration; but in a variety, which is mainly or entirely from Assam, the horns are directed straight outwards for the greater part of their length, and then suddenly curve upwards. In the cow the horns are considerably longer and thinner, with a much less marked angulation in front, than in the bulls; and it is in this sex, so far as our experience goes, that the horns with the straightest direction outwards are met with. The body becomes almost bare in old animals, and the general colour is ashy-black, although the legs may be whitish, or even, in domestic races, quite white below the knees and hocks. There is, however, a dun-coloured variety of this species, described by Mr. Blanford from upper Assam, in which the forehead is more convex than ordinary, and the nasal bones of the skull are much shorter.

According to General Kinloch, it is doubtful if the bull of this species ever exceeds 5 feet 4 inches (16 hands) at the withers; and in one specimen, of which he gives the dimensions, the height was 5 feet, the length from the nose to the root of the tail 9 feet 7 inches, that of the tail 3 feet 11 inches, and the girth 8 feet 3 inches. In the same specimen the length of the horns, measured from tip to tip along the greater curve, was 8 feet 3 inches. A skull in the British Museum has horns measuring 12 feet 2 inches from tip to tip along the curve; while a detached horn in the same collection has a length of 6 feet 6½ inches, which indicates a span of about 14 feet from tip to tip in the pair.

Distribution. In a truly wild state the Indian buffalo is only known definitely in the country from which it takes its name, the herds which are found in a wild state in Burma and the Malay Peninsula and adjacent islands, being not improbably descended from animals escaped from captivity. Our illustration is taken from an individual of one of these feral races in Java, where they are known by the name of karbu.

In India wild buffaloes are found on the plains of the Brahmaputra and Ganges, from the eastern end of Assam to Tirkut; they also occur in the "terai" land at the foot of the Himalaya, as far as Rohilkund, as well as on the plains near the coast in Midnapur and Orissa, and in the eastern portions of the Central Provinces, as well as in the north of Ceylon. Domesticated buffaloes are found not only over the whole of India and Burma, and the greater part of the Malayan region, but have likewise been introduced into Asia Minor, Egypt, and Italy.

Habits. The haunts of the wild Indian buffalo are the tall grass-jungles found in many parts of the plains of India, and generally in the neighbourhood of swamps; but it may be also found more rarely in the open plains of short grass, or among low jungle, and occasionally even in forest. Those who have never had the opportunity of seeing an Indian grass-jungle can have but little conception of its height and density, but some idea may be formed of it from the following statement of General Kinloch, who writes that in such cover "frequently, although a herd of buffaloes may be roused within a score of yards, the waving of the grass, and perhaps the glint of a polished horn-tip, is the only ocular evidence of the presence of the animals; the probably nearly noiseless rush

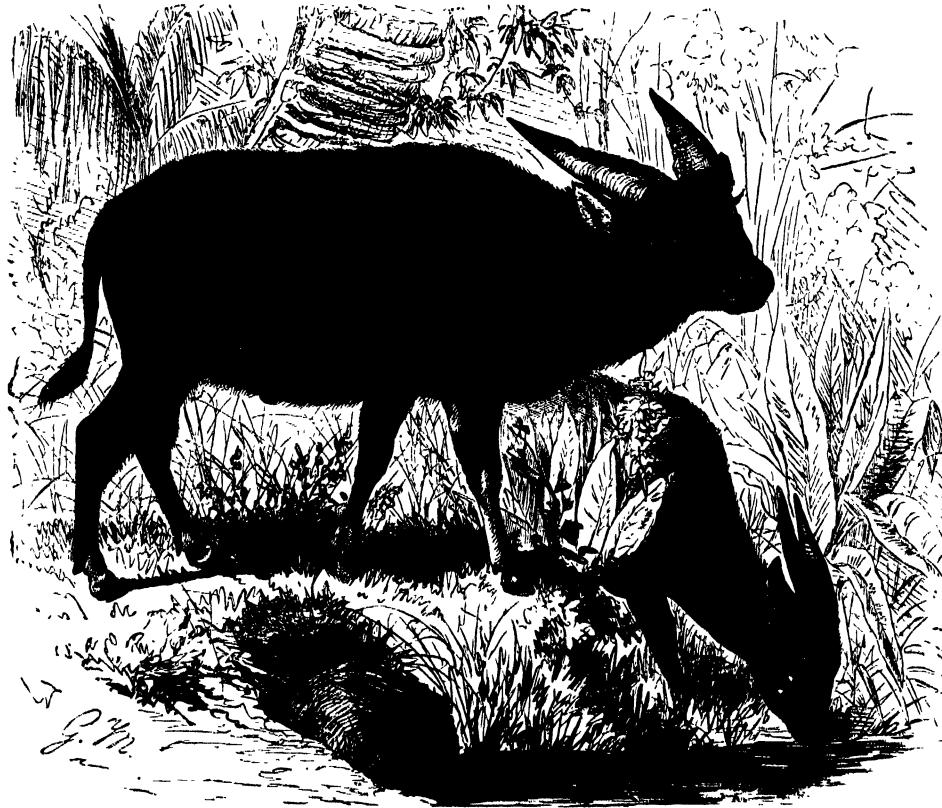
might be caused by other animals; and where the horns have not been seen it is only by the strong, sweet bovine scent—similar to, but much more powerful than, that of cows—that one can be absolutely certain of what is in front of one." In such jungles, needless to say, shooting (or indeed advancing at all) on foot is out of the question, and the only method of procedure is by beating with a line of elephants.

In their wild state these buffaloes are always found in herds, which may comprise fifty or more individuals. Mr. Blanford states that "they feed chiefly on grass, in the evening, at night, and in the morning; and lie down, generally in high grass, not unfrequently in a marsh, during the day; they are by no means shy, nor do they appear to shun the neighbourhood of man, and they commit great havoc amongst growing crops. Sometimes a herd or a solitary bull will take possession of a field and keep off the men who own it. In fact buffaloes are by far the boldest and most savage of the Indian *Bovidae*, and a bull not unfrequently attacks without provocation, though (probably on the principle that a council of war never fights) a herd, although all will gallop to within a short distance of an intruder and make most formidable demonstrations, never, I believe, attacks anyone who does not run away from them. A wounded animal of either sex often charges, and has occasionally been known to knock an elephant down. Buffaloes retain their courage in captivity, and a herd will attack a tiger or other dangerous animal without hesitation, and, although gentle with those they know and greatly attached to them, they are inclined to be hostile to strange men and strange animals. Whether wild or tame they delight in water, and often during the heat of the day lie down in shallow places with only parts of their heads above the surface." The same author remarks that few animals have changed less in captivity than tame buffaloes, which never interbreed with the humped Indian cattle. The calves are born in summer, and there are not unfrequently two at a birth. In walking, the Indian buffalo always carries its head low down.

Fossil Indian Buffaloes. Remains of the Indian buffalo occur fossil in the gravels of the Narbada valley, and likewise in parts of the Punjab. The broad-horned buffalo (*B. platyceros*) of the Siwalik Hills of Northern India, was, however, a perfectly distinct extinct species, characterised by the broad triangular horns being placed closer together on the forehead, and directed rather forwards than backwards, so that the forehead is nearly flat; they are also placed more below the plane of the occiput. Other extinct Siwalik buffaloes (*B. occipitalis* and *B. acuticornis*) were of smaller size, and their skulls like those of the tamarao and anoa; the horns rising upwards in the plane of the face, with but slight divergence or curvature, and their cross-section either triangular or pear-shaped.

The Tamarao. The tamarao of the Philippines (*B. mindorensis*) is a sturdily-built dwarf buffalo, connecting the preceding with the following species. It stands about $3\frac{1}{2}$ feet in height, and has coarse thick blackish brown hair. The horns, although massive, are comparatively short, and rise upwards in the plane of the face with a lyrate curvature; they are distinctly triangular, with the largest face in front, and are somewhat roughened. In its massive horns, thick legs, and uniform coloration, this species comes nearer to the Indian buffalo than to the anoa.

The Anoa. The anoa of Celebes (*B. depressicornis*) is the smallest and most slenderly built of the oxen, and, although allied to the buffaloes, comes nearest in structure to the antelopes. In size it is inferior to a Highland cow, its height being about 3 feet 3 inches, with the hind-quarters rather higher than the withers. The horns are ringed and triangular at the base, of considerable length, sharply pointed, and rising upwards in the plane of the face, with but a small divergence and curvature. They are situated far below the plane of the occiput, and consequently rise near the eyes; in old males they may be as much as

THE ANOA ($\frac{1}{10}$ nat. size).

24 inches in length, but in cows they are always small. The hinder part of the skull is more like that of an antelope than a buffalo, having no distinct crest on the occiput. The ears are small, haired at the base, but naked at the tips, with a bunch of white hairs internally; and the skull narrows towards the muzzle. The tail about reaches to the hocks. The general colour of the hair is dark brown, lighter below, but there are two small spots of white on the sides of the head below the eyes, while the lower part of the legs, and often the back, have also white markings. In the young animal the hair is of considerable length and thickness, but it tends to become thin with age, and in very old individuals the skin is nearly bare. In young animals the hair is reddish yellow. The largest known horns have a length of nearly $12\frac{1}{2}$ inches. The anoa has a considerable resemblance to a

young Indian buffalo, and it agrees with the members of that group in its triangular horns, in the short and sparse hair of the adult, in the large and naked muzzle, and the barrel-like form of its body. It likewise resembles those animals in its bovine smell, its fondness for water and shade, and its habit of drinking by long draughts instead of by short gulps. On the other hand, the anoa approximates to the antelopes in its slender build, the structure of the hinder part of its skull, the upright direction and straightness of its horns, the spots on the head, body, and limbs, and its small size. In connection with the aforesaid fossil species from the Siwalik Hills, the anoa clearly indicates a close connection between the antelopes and the buffaloes; and from these primitive antelope-like buffaloes the other more specialised groups of oxen may have been developed.

THE MUSK-OX.

Genus *Ovibos*.

In the desolate regions of the far north of the Western Hemisphere, where even in summer the surface of the ground scarcely thaws, is found the curious musk-ox (*Ovibos moschatus*), which although presenting a certain superficial resemblance to the oxen, is in reality far more nearly allied to the sheep. It derives its name from the peculiar musky flavour with which the flesh is tainted, and it forms the single living representative of a distinct genus.

The musk-ox is about two-thirds the size of the American bison, but from its long coat of hair looks larger than it really is. In appearance the animal has been compared to a large hairy ram; and it resembles the sheep in the marked convexity of the profile of the face and the hairy muzzle. The head is broad, with the small and pointed ears almost concealed by the hair; the latter being long and thick, and generally of a dark brown colour, although paler in the spring. Though matted and curling on the back, the hair on the throat and flanks is straight and reaches down to the middle of the legs; it also entirely hides the very short tail. Beneath the hair is a coat of fine soft wool, of a light brown colour. The most striking peculiarity of the animal is, however, to be found in its horns. In the bulls the horns have very wide and flattened bases, covering a large portion of the forehead, and meeting one another in the middle line; at first they curve sharply downwards, becoming at the same time gradually narrower and less expanded, and then curving sharply upwards and forwards, terminating in front of the eyes. The bases of the horns are very rough, and of a yellowish-white colour, but they gradually become less rough, and at the same time darker, till at the tips, where their section is cylindrical, they are smooth and black. In the young rams and the cows the horns are much smaller, and separated from one another by a considerable interval in the middle line. The limbs are short and massive; and the feet are peculiar in that while the outer hoof of each is rounded the inner one is pointed; there is a considerable growth of hair between the hoofs, which aids the animal in obtaining a sure foothold on the ice. The molar teeth of the musk-ox are like those of the sheep, and thus quite different from those of the oxen. Average-sized horns are about 24 or 25 inches in length, but they may reach $27\frac{1}{2}$ inches.

Distribution. The range of the musk-ox in Arctic America is limited to the southward by the 60th degree of latitude, but extends northwards to the 83rd degree in Grinnell Land. It abounds on both the east and west coasts of Greenland, and in Arctic America its range is bounded to the eastward by the Mackenzie River, flowing from the Great Slave lake in about longitude $67^{\circ} 30'$, while westwards it extends nearly to the Pacific. In former years the range of the animal reached considerably farther south, it having been found, in the year 1770, near Fort Churchill, on the west coast of Hudson Bay, in latitude $58^{\circ} 44'$.



THE MUSK-OX ($\frac{1}{5}$ nat. size).

In prehistoric or Pleistocene time the musk-ox also ranged to the north-west into Alaska, its fossilised remains having been found in the frozen soil of Kotzebue Sound in Behring Strait, and also in the upper part of the Porcupine River in Canada. At a still earlier period—probably when the whole of North America was far colder than at present—the musk-ox ranged as far south as Kansas and Kentucky, where its remains have been found between the 35th and 40th parallels of latitude. The remains from these localities have, however, been regarded as indicating an extinct species. Passing eastwards from Alaska across Behring Strait into Asia, musk-ox bones are found in the frozen soil of Siberia, as far eastwards as the Obi River. The animal doubtless once ranged right across Russia, since there is evidence of its former existence in Germany as far south as Würtem-

berg. Thence it extended into France, but the Pyrenees and Alps seem to have marked the southern limits of its range. In England remains of the musk-ox have been found in superficial deposits, and its skulls have been dredged from the Dogger Bank. Although the alteration in climatic conditions affords a sufficient reason for the northward retreat of the musk-ox, we are at present quite in the



HEAD OF BULL MUSK-OX.

dark why it has disappeared from the Eastern Hemisphere, while the reindeer still has a circumpolar distribution.

Habits. The regions inhabited by the musk-ox are of the most barren and inhospitable nature. It has been considered that the animal migrated southwards during the coldest part of the year, but this is denied by Mr. H. Biederbeck, who is one of the few explorers who have seen it in its wild state. It was met with by his party in Grinnell Land in March, when the snow is deepest

and the temperature lowest, and it inhabits that country and North Greenland throughout the year. "The musk-oxen travel in herds, and it is but an exception when one of them is found alone. This herding gives them a better chance to defend themselves against their one enemy, the Arctic wolf, and also gives them through close contact, additional warmth and protection against cold and winds."

Occasionally, we are also informed by Mr. Biederbeck, the Eskimo **Hunting.** undertake an expedition into the interior for the purpose of hunting the musk-ox for the sake of its warm pelage, which is used either for their own bedding, or as an article of barter. The animals are hunted by means of dogs, each hunter taking two or three of these animals with their sledge-traces attached, and thus allowing himself to be pulled along till within a short distance of the quarry.



The difficulty is then to slip the dogs at the right moment without allowing their traces to drag behind them, and thus be liable to be trodden on by the bayed musk-oxen; but clever hunters obviate this by tying the traces in a bundle on the backs of the dogs just before they are slipped. When bayed and surrounded, the members of the herd are shot down by the score, the great object being to kill each animal outright, as otherwise there is great danger of its struggles inducing a stampede among the herd, which would involve another hunt. Sometimes, however, the herd, even after having made a bolt, will return to the spot where their comrades have fallen. When scenting danger, the musk-oxen, says Mr. Biederbeck, "always retreat to some elevation near by, and upon the approach of the enemy they form in a perfect line, their heads toward their foe; or, if attacked at more than one point, they form a circle, their glaring, blood-shot eyes restlessly watching the

attack ; and I think it would go hard with the man or beast who, under such circumstances, might come within reach of their broad horns or hard hoofs."

In spite of its coarse grain, the meat of the musk-ox is described as being juicy and tender, that of the young animals being especially so, but in order to obviate the musky flavour it is essential that the carcase should be dressed as soon as killed.

SHEEP.

Genus *Ovis*.

Although nearly allied to the musk-ox, the sheep form a group distinguished by several important characters from the oxen, but passing almost imperceptibly



SKELETON OF MOUFLON.

into the goats. They are of smaller size than the majority of the oxen, and although comparatively short-necked, carry their heads higher above the level of the back. Both males and females are furnished with horns ; but whereas those of the former are large, and frequently extremely massive at the base, those of the latter are small and narrow. In the males the horns are generally more or less

triangular in section, and marked by parallel transverse wrinkles, while their colour is greenish or brownish ; they are directed outwardly from the sides of the head, their upper border being at first always convex, and the curvature generally taking the form of an open spiral, with the tips turned outwards. The face has generally, but not always, a small gland below the eye, and there is a corresponding depression in the skull for its reception ; and the muzzle differs from that of the oxen in being pointed and covered with short hair. Another distinctive feature of the group is the presence of a small gland in each foot between the hoofs ; and the females have but two teats in place of the four of the oxen. The males of all sheep are devoid of any strong odour ; neither have they any beard on the chin. As a rule, in wild species, the tail is very short ; but in one case it reaches just below the hocks. The ears are of moderate length ; and the hair, in wild species, is short and stiff, although it may be elongated on the throat and fore-quarters. The upper molar teeth differ from those of the oxen in having narrow crowns without any additional column on the inner side. The feet have only the upper ends of the lateral metacarpal and metatarsal bones remaining.

As regards the characters of their molar teeth, the sheep resemble the gazelles, and it is accordingly not improbable that they may trace their descent to extinct antelopes more or less nearly allied to that group. Oxen, on the other hand, having molar teeth nearly similar to those of the sable antelope and oryx, may be more nearly allied to the ancestors of that group.

Distribution. Sheep are represented at the present day by eleven wild species, which are mostly inhabitants of Europe and Asia northwards of the outer range of the Himalaya ; although one species occurs in the Punjab and Sind, a second in Northern Africa, and a third in North America. They associate either in parties of two or three individuals, or in flocks of considerable size ; and are essentially mountain animals. Very generally, however, sheep inhabit the more open mountain districts, rather than the craggy and steeply-scarped regions selected by the goats.

Most of the species are very nearly related to one another, and in several instances it is difficult to determine whether certain forms ought to be regarded as distinct species or merely as local races. Geologically, the sheep are even a more modern group than the oxen, none of them being definitely known to occur before the epoch of the so-called forest-bed of the Norfolk coast, which belongs to the upper part of the Pliocene or the lower part of the Pleistocene period.

THE AMERICAN AND KAMSCHATKAN WILD SHEEP (*Ovis canadensis* and *O. nivicola*).

The American wild sheep or "bighorn" (*O. canadensis*) and the Kamschatkan wild sheep (*O. nivicola*) are two very closely-allied species, differing in several important respects from the other members of the genus. The most distinctive



BONES OF THE LEFT FORE-FOOT OF THE SHEEP. — From Dawkins.

characteristic of these species is to be found in their horns, which, while very large and massive, are distinguished by the slight development of the wrinkles on their anterior surface, and the great prominence of the outer anterior angle, and the rounding-off of the inner one. In the skull the depression for the gland below the eye is extremely shallow; and both in this respect and in the smoothness of their horns, these species show an approximation to the goats.

American Wild Sheep. The American wild sheep is a large animal, with the summer coat of a light brown colour, often showing a reddish tinge, while in winter it is bluish grey on the upper-parts. The under-parts, as well as portions of the legs, are white; and there is a large and conspicuous white patch on the rump, which extends upwards on either side of the tail. The back has a more or less distinct dark stripe, reaching to the tail; the latter being very short, and



SKULL OF KAMCHATKAN WILD SHEEP. (From Guillemand's *Cruise of the Marchesa*).¹

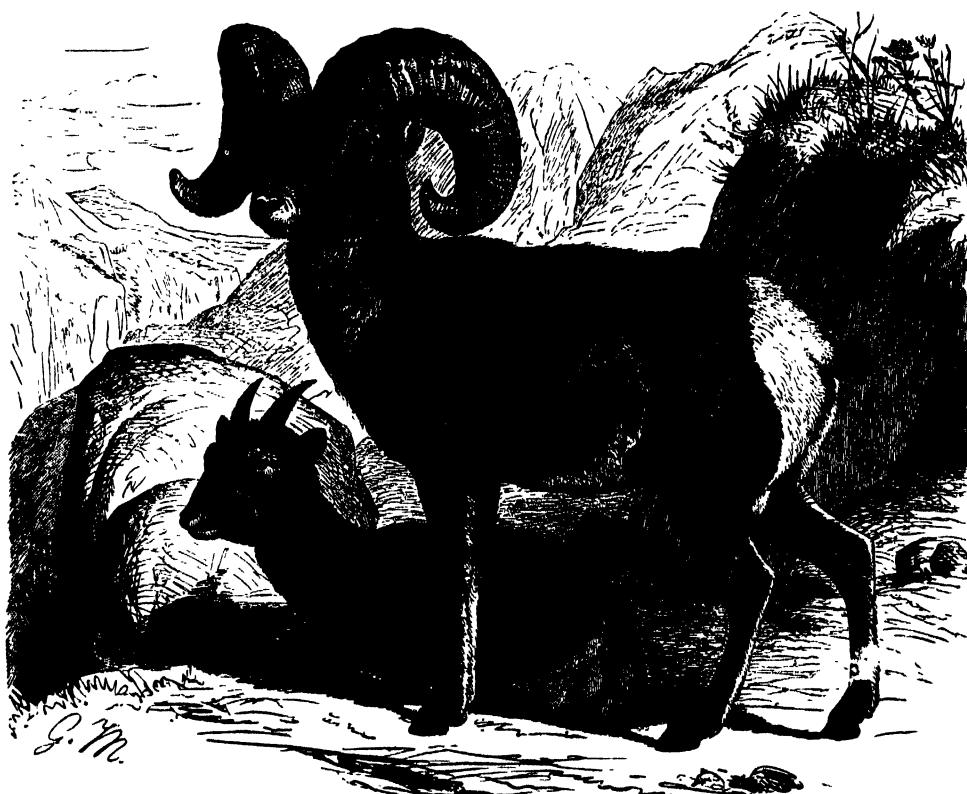
black in colour. The end of the muzzle is light-coloured. Beneath the hair there is a shining white under-wool. Very old males may become very light coloured throughout. The rams attain a height of about 3½ feet at the withers; and their average weight is about 350 lbs., or rather less. The ewes stand about 3 feet in height, and weigh about a third less than the rams. The length of horns in good specimens, measured along the curve, varies from 33 to 36, or even 40 and 41 inches; the broken tips frequently rendering them shorter than they would be, if perfect. A horn measuring 33 inches in length had a basal girth of 16 inches; while in one belonging to Mr. Otho Shaw, of which the length is 40 inches, the basal girth is only 15½ inches.

Distribution. According to Mr. G. O. Shields, the geographical range of the American wild sheep extends from Mexico to Alaska, and from the eastern flanks of the Rocky Mountains to the Pacific coast; although there are some mountain ranges within this area upon which it has never been observed. Along the valleys of the Missouri and Yellowstone Rivers it extends, however, some

¹ We are indebted to Dr. Guillemand and Mr. Murray for this figure, and also for the one of the head of the same species.

four hundred miles to the eastwards of the Rocky Mountains, inhabiting the so-called "Bad Lands" of these districts.

Varieties. According to the observations of Col. J. Biddulph there are two distinct varieties of this sheep, the one inhabiting the northern, and the other the southern portion of its distributional area. The southern variety is characterised by its large skull and very massive horns; the tips of the latter being generally broken and directed forwards. The ears are large, broad, pointed, and deer-like, with hair of only very moderate length. In the northern race, on the other hand, the skull is smaller, and the horns less massive, with their tips generally



THE AMERICAN WILD SHEEP OR BIGHORN ($\frac{1}{2}$ nat. size).

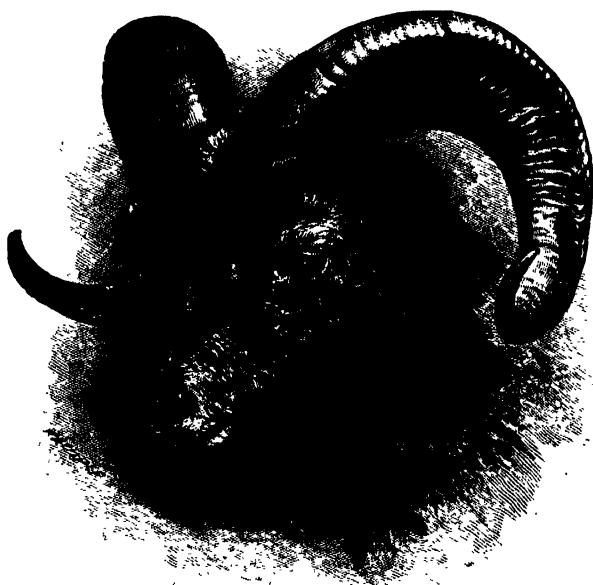
entire, and directed outwards, as in the skull of the Kamschatkan species represented in the figure on p. 214. The ears are small and thickly furred, with blunted extremities; and there is a tuft of long hair between the ears at the back of the horns. There are, moreover, certain differences in the coloration of the legs in the two races; and it does not appear that the southern one ever assumes the dark winter coat frequently found in the northern variety.

Habits. The American wild sheep is described as one of the wildest and most wary of all the large mammals of North America; and since it appears to inhabit more difficult and rugged ground than many of the other species, its successful pursuit is proportionately difficult. Mr. J. Muir writes that "in spring and summer the full-grown rams form separate bands of from three to

twenty, and are usually found feeding along the edges of glacier-meadows, or resting among castle-like crags of the high summits; and whether quietly feeding, or scaling the wild cliffs for pleasure, their noble forms, and the power and beauty of their movements, never fail to strike the beholder with lively admiration. Their resting-place seems to be chosen with reference to sunshine and a wide outlook, and most of all to safety from the attacks of wolves." It is stated that flocks of these sheep have, on more than one occasion, been known to leap down a precipice of one hundred and fifty feet in height.

This species was formerly found in large flocks, but is now rapidly diminishing in numbers; so that, according to Mr. Shields, where it was at one time found in bands of several hundred individuals it is now rarely that more than fifty are seen together. Sentinels are posted in prominent positions to give notice to the herd of the approach of danger; and the agility of these animals in making their way over glaciers and crags is said to be unsurpassed. In summer these sheep will occasionally ascend as high as twelve thousand feet; but in the spring they wander into the valleys in search of fresh pasture or salt lakes. The lambs, which are occasionally two at a birth, but usually one, are produced in May and the beginning of June, and when but a few days old will follow their mothers up apparently inaccessible cliffs. The flesh of this sheep is said to be equal in flavour to the best venison. The Indians hunt the bighorn by tying a pair of horns on their heads, when they are able to creep within range.

Kamschatkan Wild Sheep. The Kamschatkan wild sheep, of which the head is represented in the accompanying woodcut and the skull in the figure on p. 214,



HEAD OF THE KAMSCHATKAN WILD SHEEP.
(From Guillenard's *Cruise of the Marchesa.*)

Distribution. The Kamschatkan sheep is found in the Stanovoi Mountains to the north of Okhotsk, as well as in the peninsula of

is so very closely related to the northern variety of the American species, that it may be a question whether it is really anything more than a geographical race of the latter. Thus both have the comparatively small skull, and relatively slender horns with entire and outwardly directed tips; while in both there is the same tuft between the small hairy ears. The ears of the Kamschatkan sheep are, however, rounded instead of blunt; and the white patch on the rump is smaller, and does not extend above the tail, while there is no trace of a dark stripe down the back.

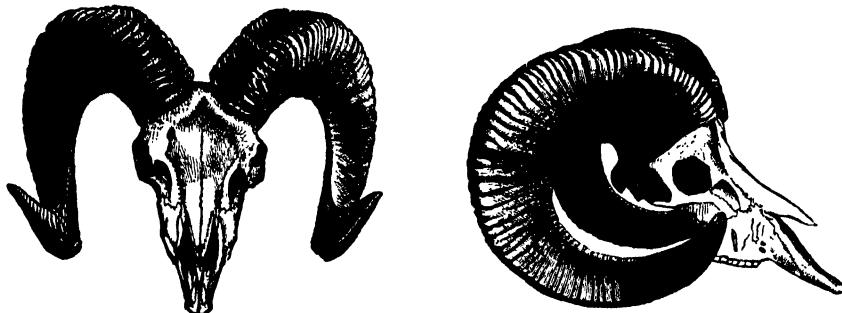
Kamschatka, and since it may also extend somewhat to the eastward, it is obvious that its range is separated by little more than Behring Strait from its American cousin in Alaska. Hence it is evident that such difference as there is between the two is merely due to their isolation from one another since the period when there was a free communication between North-Eastern Asia and Alaska. Dr. Guillemand found these sheep abundant on the eastern coast of Kamschatka, about fifty miles to the north-east of Petropaulovsky; his party having shot fourteen adult rams in two days. He describes them as standing about 3 feet 4 inches at the shoulder on the average; and the largest horns he obtained measured 38 inches along the curve, with a basal girth of 14 inches. "The general colour," writes Dr. Guillemand, "is a brown-grey, the head and neck rather greyer than the rest of the body. Both tail and ears are remarkably short. The coat in those that we shot was very long and thick, almost like that of a reindeer; but autumn was well advanced, and I have no doubt that in summer it is much thinner. It was curious that we should not only never have shot, but never even have seen, the females. All those that fell to our rifles were rams of (as far as we could judge) from three to six years old. Whether the females always herd together or only at certain seasons it is difficult to say, and we were unable to get any information from the natives upon this point. The taste of the meat when quite fresh was slightly rank, but upon the second day the unpleasant flavour had entirely disappeared."

THE MONGOLIAN AND TIBETAN ARGALIS (*Ovis ammon* and *O. hodgsoni*).

The magnificent wild sheep of Mongolia known as the argali (*O. ammon*), and a very closely-allied species (*O. hodgsoni*) found in Tibet, are readily distinguished from the American and Kamschatkan members of the genus by the characters of their skull and horns. The skull has a much deeper pit for the gland below the eye; and the enormous horns have the wrinkles on the anterior surface very strongly marked, and their outer anterior angle much less prominent, the inner one being more distinct.

The two species, or perhaps varieties, are so closely related that one description will do for both; but the true argali appears to be distinguished by the absence of a ruff on the throat, while in one specimen in the British Museum there is no distinct light-coloured patch on the rump. The argalis may be compared in size to a large donkey; and have short, coarse, and close hair, small ears, and a very short tail. In the males of the Tibetan species the hair on the sides and under-part of the throat is lengthened so far as to form a white ruff, and there is also a shorter crest of dark hair running along the back of the neck to the shoulders. The colour is greyish brown above, but whitish beneath; and in the males there is, as a rule, a large white patch surrounding the tail and embracing a considerable portion of the rump, while the throat, chest, and under-parts, as well as the inner sides of the legs, are likewise white. The crest of hair on the neck and a stripe down the outer side of the legs are dark, and there is also a dark mark above the tail. In very old rams the fur of the back becomes greyish by the admixture of white hairs; and Mr. Blanford considers it probable that in winter the whole colour is paler than in summer. In the ewes the long hair on the back and throat character-

istic of the Tibetan argali is but little developed, or absent; and the light patch on the rump is indistinct. The massive and closely-wrinkled horns of the rams are light brown in colour, with their edges much rounded, and their lateral surfaces considerably deeper than the one in front; they form a spiral curve, with the tips diverging but slightly outwards, and the whole twist falling somewhat short of a complete circle. As in the American wild sheep, the horns of the ewes are small, thin, widely separated, and nearly erect, with a slight outward and backward curvature. The adult ram of the Tibetan argali stands from $3\frac{1}{2}$ to 4 feet at the shoulder; but the weight does not appear to have been ascertained. The horns of fine specimens generally measure from 36 to 40 inches along the curve, with a basal girth of 16 or 17 inches; but these dimensions are sometimes exceeded. The horns of a specimen in the collection of Mr. Otho Shaw have a length of $47\frac{1}{2}$ and a girth of 17 inches; and in another pair the length has been stated to be 48 inches, with a girth of 20 inches. Some degree of doubt attaches, however, to an alleged length of 53 inches, and a girth of 24 or 25 inches, which have been given as the dimensions



FRONT AND SIDE VIEWS OF SKULL AND HORMS OF TIBETAN ARGALI. (From Sir V. Brooke,
Proc. Zool. Soc., 1875.)

of one example. In ewes the horns are seldom more than 18 inches, but it is stated that they may occasionally reach 24 inches.

Distribution. The range of the true argali appears to have been much restricted at the present day, owing to the animal having been driven from many parts of Northern Siberia by the Cossack hunters. Formerly occurring in the Altai, it is now found over Northern Mongolia, and, according to Brehm, some portions of Southern Siberia. The sheep from Mongolia to the north of Pekin, described as *O. jubata*, is probably not specifically distinct from this species; and the same remark will apply to the *O. nigrimontana* of Turkestan. The term argali is the Mongolian name of this sheep, but it is known to the Kirghiz as the arkal.

The Tibetan argali—the nyan (female nyanmo) of the Ladakis—inhabits the Tibetan plateau from Northern Ladak to the districts northwards of Sikhim, and probably still farther to the east. It is unknown to the southward of the main axis of the Himalaya, and in summer does not descend below an elevation of fifteen thousand feet, but in winter may occasionally come as low as twelve thousand feet.

Habits. The true argali is stated to inhabit mountains at an elevation of from three thousand to four thousand feet above the sea, which have an abundance of naked rocks, but have their slopes thinly covered with forest, and

their valleys wide and open. Here these sheep dwell throughout the year, rarely travelling from one mountain range to another; a single flock, when undisturbed, frequently inhabiting one and the same mountain for many successive years. Up to the breeding-season the rams and ewes keep separate from one another, the former generally going in parties of from three to five individuals, while the latter are found singly; but shortly before that time the two sexes assemble together in flocks of from ten to fifteen in number. They appear to be essentially diurnal in their habits, feeding in the morning and evening on the mountain slopes and valleys, and retiring to rest about midday. Both when feeding and sleeping, sentinels are placed to warn the flock of danger. In summer the argalis feed on grass and various herbs, but in winter they are compelled to subsist on moss, lichen, and dry grass. At such seasons they resort to the more exposed portions of the mountains, as it is there only that the wind has blown away the snow from the lichens and other herbage. According to Prejewalski, the pairing-season of the argalis in Mongolia is in the month of August; but Brehm was informed by the Kirghis that in Southern Siberia it does not take place till October. The younger ewes almost invariably give birth to only a single lamb at a time, but the older ones frequently have two.

As with the American wild sheep, it has been frequently asserted that the argali when taking a long leap will break its fall by alighting on its horns. In both instances this statement has however been contradicted by the most reliable authorities. Prejewalski states he has seen these sheep leap down from a height of from eighteen to thirty feet and alight on their feet without harm.

The country inhabited by the Tibetan argali is of the most barren and desolate nature, scorched in summer during the day by the untempered rays of the sun, and swept during the night and throughout the winter by blasts of icy coldness. For days the traveller may journey through these arid regions without seeing a trace of a bush, although he may here and there come across some low bush-jungle in the more sheltered valleys. As a rule, the elevations are undulating and shelving, and the valleys wide and open. In such exposed situations animals naturally become extremely wary, but this wariness is carried to the highest degree in the rams of the present species, which are considered by General Kinloch to be more difficult to stalk than any other kind of Indian or Tibetan game. The females and young rams, on the other hand, are not difficult to approach, and in Ladak may not unfrequently be met with in considerable numbers. In spite, however, of their general wariness, adult rams will occasionally approach within rifle-shot; the present writer on one occasion having seen a ram accompanied by two ewes cross a pass and deliberately descend the valley to within a short distance of the spot where he himself was lying concealed. During the summer the old rams are generally found in small parties of from three to four to upwards of some fifteen individuals of their own sex, and quite apart from the ewes; but the above-mentioned instance shows that they may occasionally be accompanied by them. The breeding-season is in the winter, when these sheep collect in the lower and more sheltered valleys; and the young are born in May or June. The flesh of the nyan, as the author can testify from personal experience, is most excellent, being dark-coloured, fine-grained, and well-flavoured. In Ladak the chief haunts of this

splendid sheep are the Chang-Chenmo valley and the neighbourhood of the Pang-kong lake, and thence into Chinese Tibet. A wild hybrid between a male of this sheep and a female of the under-mentioned urial, was shot in Zanskar, and described as a distinct species under the name of *O. brookei*; while there is also a record of a hybrid between the male urial and the female nyan.

Fossil Argali. A fossil argali occurs in the forest-bed of the Norfolk coast, and remains of other species have been obtained from the superficial deposit of the continent.

THE PAMIR WILD SHEEP (*Ovis poli*).

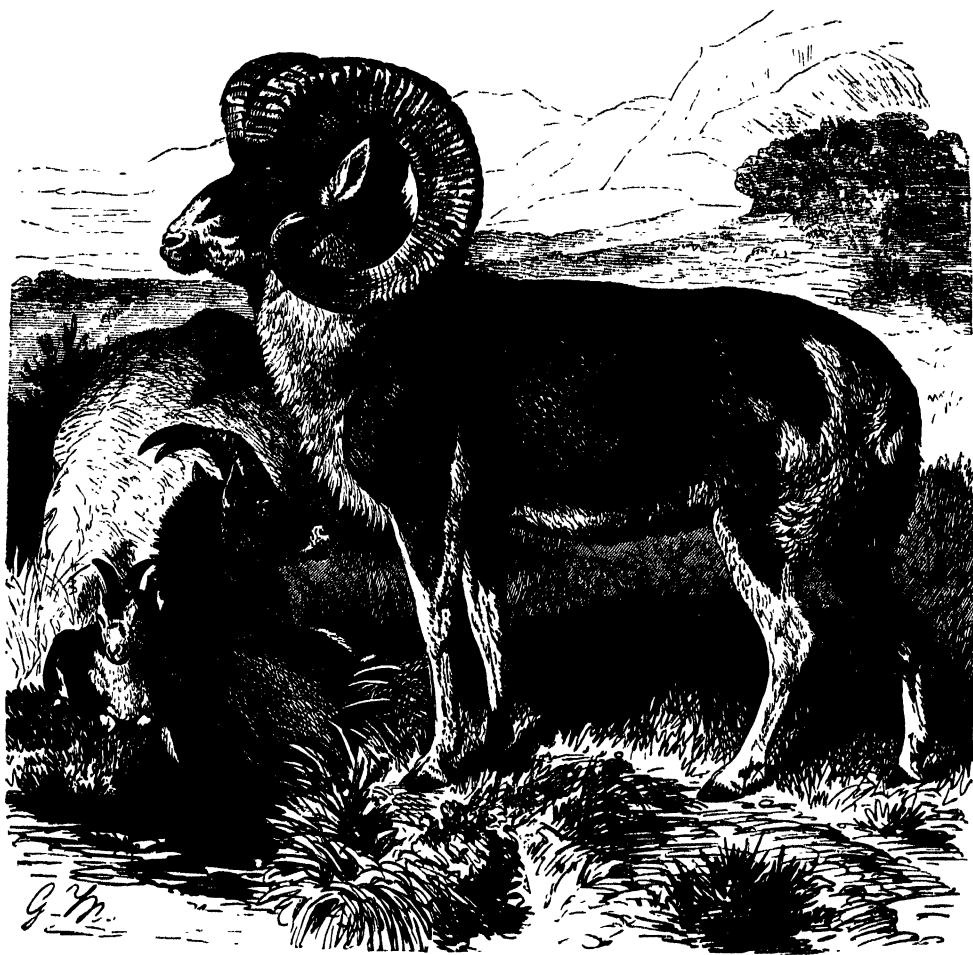
Although discovered by the great Venetian traveller as long ago as the latter part of the thirteenth century, it is only since the year 1873 that the great Pamir wild sheep has been fully known to science. In that year it was described by the Russian naturalist Severtzoff, under the name of Karelín's sheep (*O. karelini*); while specimens of the skin and horns obtained during the second expedition to Yarkand, under the late Sir Douglas Forsyth in 1873-74, were soon afterwards received in England. It is true, indeed, that the species was named by Mr. E. Blyth in 1840, but it was then only very imperfectly known. Since 1873 our knowledge has advanced rapidly; and this magnificent sheep has been shot by two Englishmen—Mr. St. George Littledale and Major C. S. Cumberland—who travelled to the Pamir for the express purpose of securing skins and horns.

The Pamir sheep, although furnished with longer horns, does not appear to attain quite such large dimensions as the Tibetan argali, from which it is mainly distinguished by the form of the horns, and also by coloration. In the male the horns, when viewed from the side, are seen to form a spiral of about a circle and a quarter; and when adult they are much longer than those of the argali, but are less massive at the base. In fine specimens the horns may measure from 50 to 60 inches in length along the curve, with a basal girth of about 15 inches; a specimen has, however, been recorded measuring 63 inches in length, while one pair attained the enormous length of 73 inches, with a basal girth of 16½ inches; and another 75 inches, with a girth of 16 inches. Females, as shown in our illustration, have small upright horns like those of the female argali. The colour of the fur on the upper-parts of the rams is light brown, with a more or less marked reddish tinge; but there is a dark line of longer hair extending from the nape of the neck to the withers, which in the female is sometimes continued as a stripe down the back. The muzzle, together with the fore-part of the neck, the chest, the under-parts, the rump inclusive of the tail, and the legs, are white. The patch of white on the rump is of irregular contour; and sometimes, as in our figure, there may be a small black mark on the upper surface of the tail. In summer it is probable, according to Mr. Blanford, that the colour is darker and browner. The ewes differ by the absence of any white on the throat. In addition to the long hairs on the nape of the neck, the old males have a more or less marked ruff on the throat. In an adult male measured by Mr. Blanford, in which the horns had a length of 48 inches, the height at the withers was 3 feet 8 inches, and the length from the horns to the tip of the tail 5 feet 2 inches, of which 5½ inches was taken up by the tail itself. As

is the case with the argali, the ewes are but little inferior in size to the rams. Dr. Severtzow estimates that an adult ram would weigh about 500 lbs.

To support the enormous weight of the horns great strength in the neck and fore-parts of the rams is essential; and this is afforded by the great depth of the neck and chest, as is well shown in our illustration.

Distribution. The Pamir sheep takes its name from inhabiting the elevated district in Central Asia known as the Pamirs, or "Roof of the World." It is also found on the table-lands to the westward and northward of Eastern



THE PAMIR WILD SHEEP ($\frac{1}{2}$ nat. size).

Turkestan; while its range extends northwards across the Thian Shan range to the Semiretchinsk Altai. It has been obtained from the head-waters of the Amu Darya, and to the north and south of the Gobi desert; while to the westward it extends as far south as the Shimshal Pamir just north of Gilgit, and thus comes within the limits of the territory under the influence of the Government of India. On the average, this sheep may be said to live at an elevation of about twelve

thousand feet, but in some districts it ascends higher, while in others it is found at much lower levels.

The typical and larger form of this sheep is the one inhabiting the Pamirs, while the rather smaller variety described as *O. karelini* is from the Thian Shan; it has been shown, however, that the one form passes imperceptibly into the other. A sheep described by Dr. Severtzow, under the name of *O. heinsi*, is probably also not specifically separable.

In the neighbourhood of Wakhan the rams of the Pamir sheep are known by the name of kuchkar, while the ewes are termed mesh; but in the Turki language, as spoken in Eastern Turkestan, the males are called kulja or gulja, and the females arkar.

Habits. The habits of this sheep appear to be almost or exactly similar to those of the Tibetan argali. It inhabits, however, a far less barren country than the latter; the undulating slopes of the Pamirs being covered in summer with a continuous carpet of rich grass. The breeding-season of this species



SKULL AND HORMS OF PAMIR SHEEP. (From Sir V. Brooke, *Proc. Zool. Soc.*, 1875.)

occurs in the winter, during the months of December and January; and at that period some of the herds may be very large.

Describing the nature of the country inhabited by the Pamir sheep, Col. H. Trotter, who was attached to the expedition under Sir D. Forsyth, observes that after passing a place called Chakmak, on the southern slopes of the Thian Shan range, the road for twenty-five miles "continues gently ascending along the course of the frozen stream, passing through volcanic rocks to Turgat Bela, a little short of which the country alters, and the precipitous hills are replaced by gently undulating grassy slopes, abounding with the *O. poli*. These extensive grassy slopes, somewhat resembling the English downs, are a very curious feature of the country, and not only attract the Kirghiz as grazing-grounds for their cattle, but are equally sought after by the large herds of gulja, in one of which Dr. Stoliczka counted no less than eighty-five."

In the Semiretchinsk Altai, according to Dr. Severtzow, these sheep are found wherever there are good meadows and rocky places, at elevations of two thousand, or three thousand feet; and the same writer states that owing to the open nature of the country, and the good grazing-grounds which they frequent, they are more easily driven from their haunts by the Kirghiz than are the ibex, which inhabit rocky and less accessible regions. In other parts of the Thian Shan, as the upper

Naria valley, these sheep are found in summer at elevations of ten thousand or even twelve thousand feet above the sea.

THE URIAL OR SHA (*Ovis vignei*).

The Asiatic wild sheep known in the Punjab as the urial, but in Ladak as the sha, belongs to a group distinguished from all the preceding species by their smaller size and less massive horns. It was long considered that the urial of the Punjab and other districts of North-Western India was specifically distinct from the sha of Ladak, but the investigations of Mr. Blanford have shown that the two forms pass into one another, and must consequently be regarded merely as varieties of a single species.

The typical urial of the Punjab stands about 2 feet 8 inches in height at the shoulder, but the Ladak variety is rather taller, its height being as much as 3 feet, or even, it is said, rather more. The horns are strongly wrinkled, and have their lateral surfaces not much broader than the front one; while their outer front angle is much more rounded off than in the argali. The two horns rise very close together, and curve round in a regular circular sweep, sometimes keeping almost entirely in the same plane, but at others forming a spiral; their curve very seldom exceeding one complete circle. In the ewes the horns are very short, and nearly straight. The average length of the horns of the rams varies from 24 to 30 inches along the curve, with a basal girth of about 10 inches; but Mr. Blanford states that a specimen has been obtained in which the length of the horns was upwards of 37½ inches, and their basal girth 11½ inches. In the sha or Ladak variety the horns are generally thicker at the base than in the true urial, their basal girth in some instances varying between 11 and 12 inches, whereas in the latter it does not exceed 10 inches; the horns frequently, moreover, form a wider circle, and their outer front edge is still more rounded off.

The adult ram of the urial is characterised by having a large ruff of long hair on the throat, commencing on either side of the chin in two distinct moieties, which soon unite and extend down the throat to the chest. In the Ladak variety the ruff is generally much less developed. In colour the fur of the urial is rufous grey or fawn on the upper-parts in the summer dress, but in winter becomes greyish brown; the under-parts, together with the rump, tail, and legs, are whitish; while in old rams the ruff is generally white in front, passing behind into black, although in some cases it may be entirely black. There is a dark brown or black patch behind the shoulder; and sometimes a blackish line dividing the white of the under-parts from the darker area, as well as blackish markings on the limbs. The ewes and young rams are of a uniform greyish brown colour.

Distribution. The geographical range of the urial is more extensive than that of any other Old World sheep, and includes districts with exceedingly different climatic conditions. The large variety known as the sha extends from Northern Tibet through Ladak and Zanskar, where it is generally found at elevations of from twelve thousand to fourteen thousand feet, through Astor and Gilgit (where it is locally known as the uria) to Afghanistan. The true urial inhabits the Salt range of the Punjab, the Suliman range, the Hazara hills, and

the neighbourhood of Peshawur, whence it ranges all through Sind, Baluchistan, and Afghanistan into Eastern Persia. The variety found in Baluchistan and Kelat is characterised by the very open spiral formed by the horns, so that the tips diverge much more than usual; this variety was at one time regarded as a distinct species under the name of *O. blanfordi*.

Regarding the different habitats of the urial, Mr. Blanford

Habits.

observes that in Ladak this sheep inhabits open valleys; in Astor and Gilgit it keeps to grassy ground at moderate elevations below the forest; in the Salt range of the Punjab, and in Sind, Baluchistan, and Persia, it is found on undulating or hilly ground cut up by ravines, and is more often seen on stony and rocky hillsides than amongst bushes and scrub. The herds vary usually from three or four to twenty or thirty in number; the sexes are generally together, but the males often keep apart in summer. These sheep are wary and active; although not such masters of the art of climbing amongst precipices as the goats, tahr, or bharal, they get over steep places with wonderful ease. Their alarm-cry is a shrill whistle, their usual call a kind of bleat. In the Punjab the breeding-season is in September, but it must be considerably later in Astor, where the lambs are born early in June. There are either one or two young at a birth; and the species will freely interbreed with domestic sheep. The Punjab and Sind urial inhabits a hotter area than any other species of wild sheep; and it is remarkable that a single species should have been able to adapt itself to climates so different from one another as are those of the Punjab and Ladak.

In the Salt range of the Punjab the urial may occasionally be seen grazing with domestic sheep; but they are soon disturbed by the sight of a European. The broken nature of the ground, with numerous sharp ridges, separated by deep and narrow ravines, renders, however, urial-stalking a comparatively easy sport.

THE ARMENIAN AND CYPRIAN SHEEP (*Ovis gmelini* and *O. ophion*).

The Armenian sheep brings us to the first of a group of three comparatively small species distinguished from the urial by the total absence of horns in the ewes, the want of a distinct ruff on the chin of the rams, and the much finer wrinkles on the front of their horns, as well as by the tail being always dark-coloured. The Armenian sheep, which inhabits Eastern Persia and Asia Minor, and is especially common in the Cilician Taurus, is the largest of these three species, the rams generally standing about 2 feet 9 inches at the shoulder. The colour of the upper parts of the body in the rams is russet-yellow, the fore portion of the head being whitish, and the under-parts, insides of the limbs, and the whole of the lower portions of the legs, as well as a streak on the buttocks, white. There is a dark mark on the front of the fore-legs above the knee, and the fringe of long hair on the lower part of the throat is also dark, as is the end of the tail. The horns have a peculiar backward and inward curvature, so as nearly to meet behind the neck, and as a rule they do not exceed 26 inches in length, but a single pair has been recorded measuring upwards of 40 inches. The females have a characteristic white saddle-mark on the back.

In the Troodos mountains of Cyprus this species is represented by the

smaller but closely-allied Cyprian sheep, which may indeed be nothing more than a geographical race of the other, diminished in size and modified by the small area of its habitat and its long isolation. This elegant species is, indeed, the smallest of all the wild sheep, the rams standing only just over 26 inches at the shoulder, and their horns not exceeding 23 inches in length. According to Col. J. Biddulph, it is distinguished from the typical form of the Armenian sheep by the horns being more slender, with their outer front angle almost completely obliterated, and their tips directed upwards instead of downwards. The fringe on the throat is also less developed and there is a much more distinct dark line dividing the white of the belly from the rufous of the flanks. There is, however, a variety of the Armenian sheep in which the horns approximate in form to those of this species.



HEAD OF CYPRIAN SHEEP.
(From Biddulph, *Proc. Zool. Soc.*, 1884.)

THE MOUFLON (*Ovis musimon*).

The European mouflon, now confined to the islands of Sardinia and Corsica, is the last member of the typical group of wild sheep. In height the rams stand about 27½ inches at the withers; the build of the animal being very compact and neat. The hair is short and close on the body, with an abundant under-wool, but in the rams is elongated into a short mane on the neck and a fringe on the lower part of the throat. With the exception of a dark brown line down the back, and a conspicuous light grey saddle-like patch on the sides of the rams, the general colour of the upper-parts is foxy red, passing into ashy grey on the head, while the muzzle, a streak on the rump, the sides of the tail, the feet, and portions of the lower parts of the legs, and the under-part of the body are white. The horns curve forwards by the side of the face, and vary in length from 20 to 28 and 29 inches.

Distribution. Although reported to have occurred formerly in parts of Greece and the Balearic Isles, it does not seem certain that the mouflon was ever an inhabitant of these countries; while Brehm is doubtful if its alleged former occurrence in Spain is a fact. At one time the mouflon was extremely numerous in Corsica and Sardinia, accounts being extant of the slaughter of four hundred or five hundred head during a single hunt. At the present day it is, however, far less numerous, so that instead of being met with in large flocks, it is now only seen in companies of from four to five up to seven individuals; while in the largest "drives" not more than forty or fifty head are ever killed at one time.

Habits. In Sardinia the mouflon, instead of being found on all the mountain ranges, are restricted to certain chains, and there they frequent only the highest ridges, generally confining themselves to such peaks as command a view of the whole of the surrounding country. The flocks of mouflon are led by an old and powerful ram; but at the pairing-season the large flocks used to split up into small parties, consisting of one ram and several ewes. The rams engage in fierce conflicts among themselves for the supremacy; and during the months of December and January the mountains re-echo with the



THE MOUFLON ($\frac{1}{3}$ nat. size).

sound of the blows as one ram rushes against the head of another. The lambs—either one or two at a birth—are produced during April or May; and are able in a few days to follow their dams everywhere. Mr. E. N. Buxton states that the Sardinian mouflon is one of the most difficult animals to approach with which he is acquainted. He observes that "when they are alarmed, or at 'gaze,' they have a habit, or at least the rams have, of placing themselves in the middle of a bush of macquia, or in the shadow which it casts. The ewes, who are naturally less conspicuous, do this in a less degree. The mouflon are assisted by the wonderful alertness of their eyes." Later on Mr. Buxton writes that "one of their favourite

devices is to seek for spots on the lee-side of a ridge where the currents of air meet. Here, in otherwise favourable positions, they are quite unapproachable." Occasionally wild mouflon will desert their own kin to live among tame sheep; while sometimes also a motherless domestic lamb has been known to seek companionship among a flock of mouflon. Evidently, therefore, the wild sheep are very closely related to our domesticated breeds.

DOMESTIC SHEEP (*Ovis aries*).

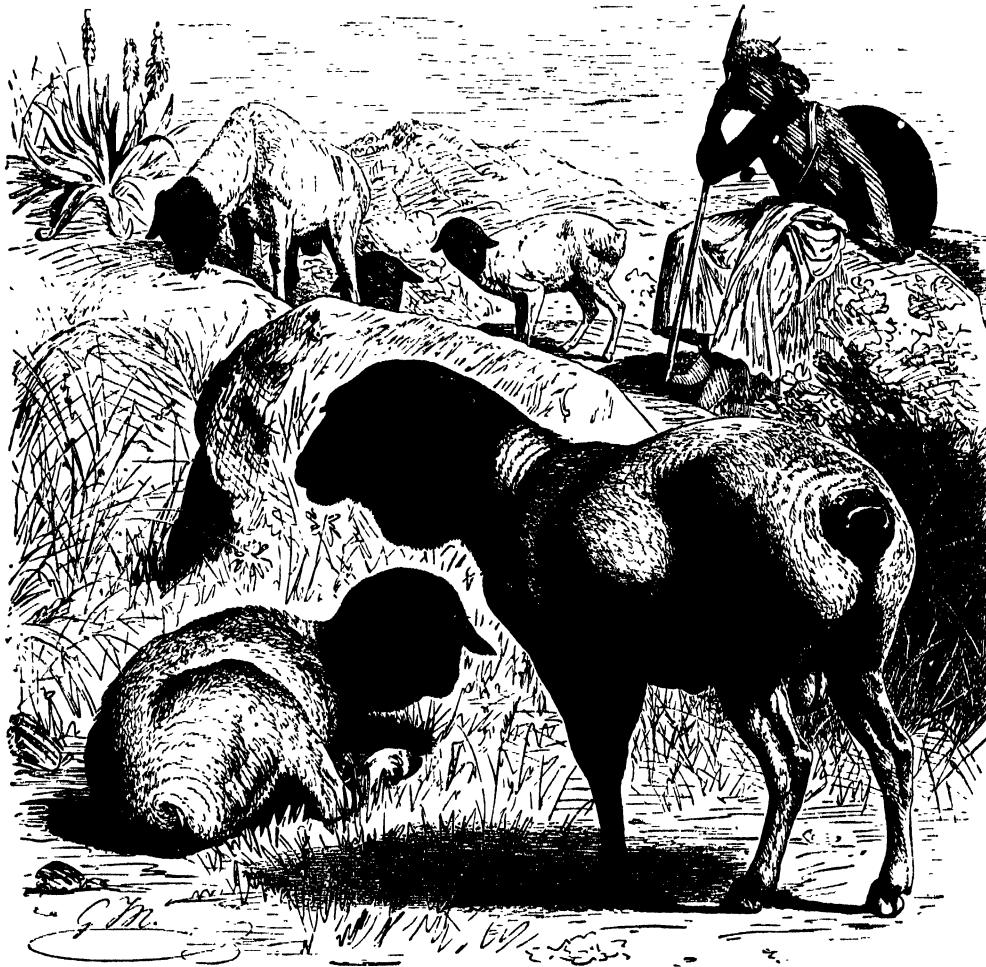
Although from the similarity in the form and structure of their horns there can be no doubt that the domestic races of sheep are more nearly allied to the mouflon, Armenian wild sheep, and urial, than to those mentioned hereafter, yet we are at present quite in the dark as to their origin; and it is an open question whether we ought to regard the various domesticated breeds as derived from a single, or from several, original wild stocks. The most important features by which most domestic races of sheep differ from their wild cousins are the length of the tail, and the substitution of a coat of wool for one of hair. No wild sheep except the under-mentioned Barbary sheep, which has horns of a totally different type, is furnished with a long tail; but it has been suggested that the long tails of the domestic breeds are due to a kind of degeneracy, although, it must be confessed that this does not much advance matters. Unfortunately, geology does not help us much in this investigation; although it is ascertained that the inhabitants of the ancient Swiss lake-villages were possessed of a breed of sheep characterised by their small size, long thin legs, and goat-like horns.

Domestic sheep vary greatly in the character of their horns. Thus while in the Dorset breed these appendages are present in both sexes, and of nearly equal size in each, in some forms only the males are provided with horns, while in other breeds, like the Southdown, they are absent in both sexes. On the other hand, there is a tendency among some breeds to produce additional pairs of horns, so that we may have four-horned, and even eight-horned, sheep. When there is more than one pair of horns, they arise from a peculiar elevated crest on the frontal bones. In the Wallachian breed the horns of the rams, as Mr. Youatt remarks, spring almost perpendicularly from the frontal bone, and then take a beautiful spiral form; in the ewes they protrude nearly at right angles from the head, and then become twisted in a singular manner.

Flat-tailed Sheep. One of the most remarkable types of domestic sheep is characterised by the tail being flattened, and either of great length or abnormally shortened. It has been considered that these sheep indicated a distinct aboriginal form, but against this view may be quoted Mr. Darwin's observation that their drooping ears are indicative of long domestication. On the other hand, the nature of the pelage in the Eastern and Ethiopian varieties of these breeds, is suggestive of a more intimate relationship with a wild ancestral stock.

In Asia Minor, Syria, and parts of Arabia, the flat-tailed sheep have their tails of enormous size, sometimes reaching a weight of from 40 to 50 lbs. So long, indeed, is the tail, that it actually trails upon the ground, and is frequently supported by little sledges in order to prevent it from incommoding its owner.

On the other hand, in the countries to the eastward of the Caspian Sea, such as Persia and many parts of Central Asia, as well as in North-Eastern Central Africa, we find that the flat tail becomes short or rudimentary, and the fat accumulates on either side of the haunches in two great protuberances. Hence this breed is designated *O. aries steatopyga*. This breed, as shown in our illustration, is of large size, and differs from most domesticated sheep in its completely hairy



THE BLACK-HEADED SHEEP ($\frac{1}{2}$ nat. size).

pelage. The coat of the adult resembles, indeed, very closely that of many wild sheep, generally consisting of short and close hair, and yielding no wool capable of being spun or woven. The lambs have, however, a perfectly woolly coat. In Abyssinia Mr. Blanford states that the fat-tailed sheep kept in the highlands differ from the ordinary breed in being covered with wool. They have also frequently well-developed and handsomely-curled horns. In our figured example of the hairy breed of these sheep, the hair is white on the body but black on the head and front part of the neck. The horns are small and curved. These sheep are kept in great

numbers by the nomad tribes of the Asiatic steppes; some preferring those which are entirely black, while others cultivate a pure white breed. A large number of lambs of the black breed are killed at a very early age for the sake of their skins, which are covered with fine curly wool, and constitute the astrachan of commerce.

The Fezzan sheep, which is brown and white in colour and has a long and round tail, has the pelage entirely in the form of hair.

It would be impossible within the limits at our disposal to mention the various breeds of round-tailed domestic sheep met with in various parts of the world; and we must, therefore, content ourselves with a brief mention of those cultivated in the British Islands.

The Shetland and Orkney breeds are characterised by their fleece

Shetland Breed. being composed of fine soft wool largely intermixed with hair. They are of small size and hardy disposition, with horns frequently present in both sexes, although often wanting in the ewes; and their colour may be either black, brown, grey, or white.

Scotch Breeds. The older soft-woollen sheep of Scotland are a small-horned breed, with lank bodies and short wool, which is deficient in the property of felting. They are nearly extinct.

Welsh Sheep. Of the Welsh sheep there are two races, both of small size. The first is the higher mountain-breed, characterised by the presence of horns in both sexes, their generally dark colour, and the intermixture of a large proportion of hair among their soft wool. The second breed is hornless, with soft wool, which is deficient in the property of felting. These sheep are hardy, and noted for the excellence of their flesh; when removed from their native pastures they are impatient of restraint.

Irish Breeds. The Irish Wicklow sheep were almost identical with the Welsh mountain sheep, but have been much altered by crossing. There are, however, several other Irish breeds, among which the Kerry is the best known. These are larger than the Welsh sheep, with the horns frequently absent in the ewes, and the fleece moderately soft, but irregular, and mixed with hair. They are late in reaching maturity, and wild in disposition.

Heath Breed. The black-faced Heath breed, which are natives of the chain of mountains and moors extending northwards from Derbyshire, are the hardiest and boldest of all the British races. Both sexes are horned, and their faces and limbs are dark-coloured, and their fleeces coarse and shaggy. When taken to lower grounds, their wool becomes finer.

Cheviots. The Cheviot breed, originally confined to a small tract of grassy hills in the north of England, are rather heavier, although less robust than the last. Both sexes are hornless, their faces and limbs are white, and they produce wool of moderate fineness.

Norfolk Breed. The old Norfolk breed, of the eastern counties of England, are strong and active sheep, with horns in both sexes, which are thick and spiral in the rams. The body and limbs are long, the head carried is high, and the face and legs are black; while the wool is silky and of medium length.

Moor Breeds. The Dartmoor and Exmoor sheep may be taken as samples of the breeds of the older forests, commons, and chases. They frequently have dark or grey faces and limbs, and may be with or without horns; while their size is small. The two races mentioned differ from the others in having wool of medium length, instead of extreme shortness.

The well-known Southdown breed, derived from the chalk hills **Southdowns.** of Sussex, are characterised by the absence of horns, their dark brown faces, ears, and limbs, and their short felting wool. Their size and weight are



HEAD OF MERINO RAM.

subject to local variation; but their heads are always comparatively small, their lower jaws thin and fine, and the space between their ears well covered with wool. A good Southdown carries more meat in proportion to offal than does any other of the short-woollen varieties.

Dorsets. The Dorset and pink-nosed Somerset breed, are indigenous to the south-west of England, and are easily recognised by their long limbs, the presence of horns in both sexes, and their white limbs and faces, the muzzle being often flesh-coloured. The wool is of medium length, and the lambs are produced unusually early. There is a variety of the Dorset breed in Dean Forest and on the Mendip Hills, small, compact animals that thrive on the poorest soil. The Portland sheep are an allied but smaller breed.

Merino. The small merino sheep, in which the males have long spiral horns while the females are usually hornless, may have either white or grey faces and limbs, and are distinguished from all other breeds by the great length and fineness of their wool. Originally a native of Spain, the breed has

spread over many parts of Europe, and has been introduced into South Africa, America, and Australia; but, for several reasons, has not found much favour with English farmers.

Long-woollen Breeds. Finally, we have the various strains of long-woollen sheep, under which heading are comprised the new Leicester, and the varieties more or less intermixed with it in blood, such as the Lincolnshire, the Romney Marsh, the Cotswold, the Devonshire, the Notts, and the long-woollen Irish breeds. They are all of large size, destitute of horns in both sexes, and bear long wool, which, while unsuitable for felting, is eminently adapted for the manufacture of worsted yarn. These sheep are stated by Mr. Low to be "more especially adapted to the plains and the districts where artificial food can be reared in the necessary quantity. They have been continually increasing in number with the extension of tillage and the general improvement of agriculture. Of the several varieties, the new Leicester breed occupies the first class with respect to form, and the aptitude to fatten readily."

THE BHARAL (*Ovis nahura*).

With the bharal, or blue sheep of Tibet, we come to the first of two wild species differing markedly from all the others in the characters of their horns and skulls, and approximating in these respects to the goats. As regards the horns, the male bharal has these appendages nearly smooth, and rounded or subquadangular at the base, while their curvature assimilates more to a letter S than to the spiral characteristic of the typical sheep. They are marked with fine transverse striæ, and rise very close together on the head; their direction is outwards, at first upwards, then downwards, and at the extremities backwards. The females have short horns, curving upwards and outwards. There is no gland on the face, and consequently no pit in the skull below the eye. The tail is relatively longer than in any of the wild species yet noticed. The fur is of uniform length throughout, without any trace of a mane on the neck or fringe on the throat, and is remarkable for its smoothness and compactness. As regards coloration, the adult male bharal is a decidedly striking animal. Thus, whereas the general colour of the upper-parts is brownish grey, becoming more distinctly brown in summer, and tending to slaty grey in winter, the under-parts, the inside and back of the limbs, as well as the rump so far as the root of the tail, are white. The front of the face, the chest, a stripe down the front of the limbs, interrupted by white at the knees, and a stripe along the side dividing the white of the belly from the dark of the upper-parts, as well as the last two-thirds of the tail, are black. The black markings on the face, chest, and flanks, are wanting in the females.

The male bharal stands about 3 feet in height at the withers, and good-sized horns have a length of 24 or 26 inches along the curve, with a basal girth of some 11 inches. Specimens have, however, been recorded measuring 30½ and 32 inches in length, and 13 inches in girth. The female bharal is altogether a smaller animal.

Distribution. The bharal is essentially a Tibetan species, ranging, according to Mr. Blanford, from near Shigar in Baltistan and the neighbourhood of Sangu, south-east of Yarkand, as far eastwards as Moupin in Eastern Tibet;

while in a north and south direction it embraces the area lying between the main axis of the Himalaya (or a few of the higher ranges to the south) and the Kuen-Lun and Altyn Tagh ranges.

Affinities. Structurally the bharal is as much a goat as a sheep, but in the absence of a beard and of a strong odour in the rams, as well as in general appearance, it is more like a sheep, and is consequently placed in the same genus. It exhibits, however, a marked difference from other species of the same general size in refusing to breed with domestic sheep; and its relationship to the goats is so strong that, were it not for convenience, there are considerable grounds for including both sheep and goats in a single genus.

Habits. In conformity with its structure, the bharal, as Mr. Blanford remarks, is intermediate in its habits between the sheep and the goats. Like the former it is found on undulating ground, and frequently lies down during the day on its feeding-ground, though generally amongst stones; but, like the latter, it is a splendid climber, perfectly at home on precipitous cliffs, and wont, when alarmed, to take refuge in ground inaccessible to man. It is found in herds of from eight or ten to fifty or even a hundred; the males and females being generally found apart in the summer, but frequently associating together at all seasons. The herds keep to high open ground above forest and never even enter bush. They feed and rest alternately during the day. Owing to their colour it is peculiarly difficult to make them out when they are lying down amongst stones." It appears that these animals are never found below an elevation of ten thousand feet above the sea-level, while in summer they range up to fourteen thousand and sixteen thousand feet. Bharal are by no means difficult of approach in districts where they have not been much disturbed, and on one occasion in Ladak the present writer came suddenly upon a flock of five rams lying asleep in an un-frequented path. They are generally well represented in the Gardens of the London Zoological Society, where they have bred freely.

THE BARBARY SHEEP (*Ovis tragelaphus*).

The Barbary, or maned sheep, which is the only wild representative of the group met with in Africa, while agreeing with the bharal in the general character of its horns and skull, is distinguished by the great mass of long hair clothing the throat, chest, and fore-limbs, and likewise by the great length of the thickly-haired tail, which reaches slightly below the hocks. Although commonly referred to in works of natural history under the name of aoudad, it does not appear that this title is recognised by the inhabitants of its native country, to whom this sheep is known as the arui.

The Barbary sheep attains a height of rather over 3 feet, and is of a nearly uniform pale rufous yellow colour, with the individual hairs differently coloured in different parts of their lengths. The females are distinguished from the males by the much shorter hair on the fore-quarters, but have horns nearly or quite so long. The horns do not generally exceed 25 inches in length, but may reach 26 or a little more, and although finely wrinkled in the young are nearly smooth in the adult.

BHARAL



Distribution. These sheep are generally found alone or in parties of two or three, and are sparsely distributed over the more precipitous regions of the arid southern slopes of the Atlas range, from the Atlantic to Tunis. They are unknown in the interior of the range near the coast, always keeping within sight of the desert, and capable, according to Arab reports, of going several days without water. Their colour harmonises admirably with the limestone rocks of their native mountains.

Habits. Mr. E. N. Buxton observes that the Arabs are in the habit of pitching their tents near the scanty springs frequented by these sheep, and daily lead their goats high up the mountains. Consequently, the arui



THE BARBARY SHEEP ($\frac{1}{2}$ nat. size).

have "no means of escaping from them, as every mountain within reach of water is similarly infested. They are constantly within sight and hearing of the Arabs and their goats, and as they cannot get away they have developed the art of hiding themselves to an extraordinary extent, and they have unlimited confidence in their own invisibility. This was demonstrated by me one evening when I sat for twenty minutes carefully spying the surrounding country. The knoll on which I sat commanded a small shallow hollow. In this there was not a vestige of cover except a few thin thuya bushes which looked as if they could not hide a rat. It was not till I rose to shift my position that a female arui and two yearlings started

from these bushes. They had been lying within sixty yards of me, and must have been fully conscious of my presence all the time. The arui, in this habit of hiding, is very like the Pyrenean ibex, which lives in rather similar ground, and also trusts to concealment in preference to flight."

In Algeria the rams of this species are distinguished as *fechta*, the ewes as *massea*, and the lambs as *charuf*.

THE GOATS.

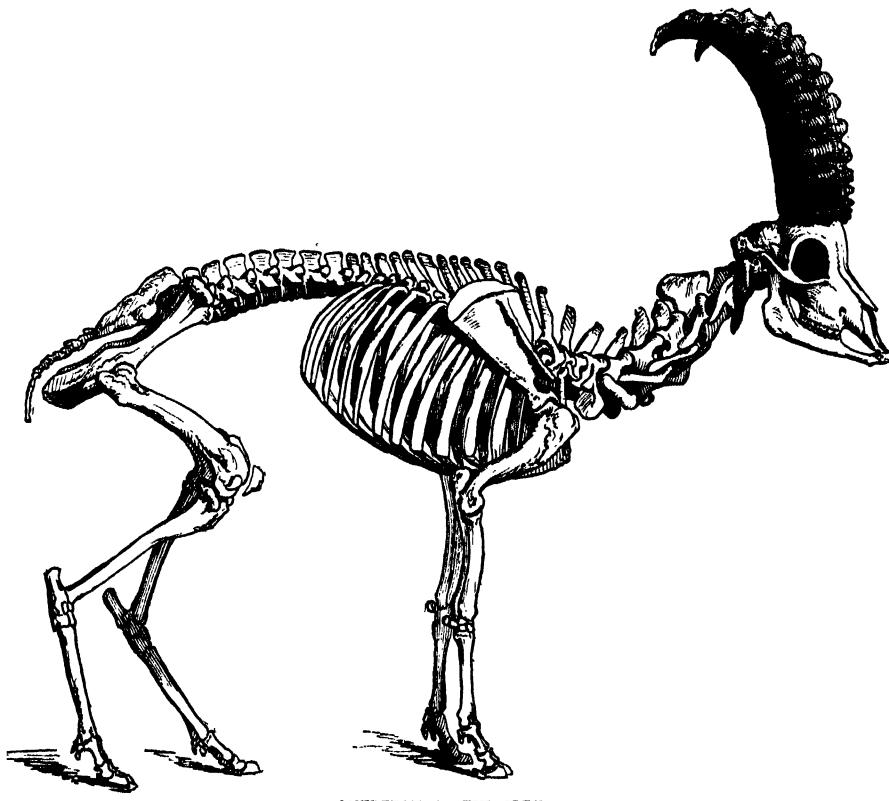
Genus *Capra*.

The two preceding species of sheep connect the more typical representatives of that group so intimately with the goats that there is some difficulty in drawing up a list of characters which will satisfactorily distinguish between the two. The males of all the goats are, however, characterised by the possession of a peculiar strong odour, while they very generally have a beard on the chin. None of them have any gland on the face below the eye (in which respect they resemble the bharal and Barbary sheep); and they differ from all the sheep in the absence of any glands between the hoofs of the hind-feet, while in some cases these glands are likewise wanting in the fore-feet. In all cases the tail is short, and there are peculiar hard patches, or callosities, on the knees, and in some instances also on the chest. The skull of a goat differs from that of a sheep in that the plane of the portion behind the horns meets that of the part in front of the same in an obtuse instead of a right angle, while the profile of the face is very concave, and the occipital region rounded instead of nearly flat. The true goats, or those constituting the genus *Capra*, are further distinguished by the great length of the horns of the males. These are situated close together immediately above the eyes, and are continued upwards at first in the plane of the forehead; they may be either scimitar-shaped, with a backward sweep, or spiral, and are generally more or less compressed and angulated, while they are frequently ornamented with knobs or knots in front. In the females the horns are much smaller, and set farther apart at their bases.

Although the term goat is applied to one American ruminant, yet goats in the proper sense of the word are exclusively restricted to the Old World. Moreover, these animals are mainly confined to Europe and Asia north of the southern flanks of the Himalaya. It is true, indeed, that one species occurs in Egypt and another in Abyssinia, but the group is quite unknown in the whole of the remainder of Africa, while the species inhabiting the mountains of Southern India is classed in a genus apart from that containing the true goats. There are about ten species of true wild goats, all of which live in herds, although the males sometimes keep apart from the females, and are occasionally solitary. Like the sheep, the goats are essentially mountain animals, but they generally inhabit more rugged and precipitous ground than do the majority of the former; this is, however, not invariably the case, as the Himalayan ibex ranges on to the open country of the Pamirs. All the members of the group are very active and wary animals, and they are characterised by their tendency to browse on the young shoots and leaves

of such trees and shrubs as they can reach, whereas sheep mainly confine themselves to grazing. On account of these browsing habits goats are extremely destructive to forests, eating off the tops of the young trees and thus preventing all new growth.

Geologically, goats appear to be somewhat older than the sheep, remains of certain species having been obtained from the Pliocene rocks of the Siwalik Hills in Northern India, while those of others occur in the superficial deposits of the plains of Central Europe. The latter belong to a species of ibex, which is a matter of some interest as showing that during a colder epoch these animals could exist



SKELETON OF THE IBEX.

in the lowlands, from whence, with an increase of the temperature, they migrated to the various mountain-chains, where they have differentiated into distinct species from isolation. This explains the occurrence of allied species of wild goats in the Caucasus and the Pyrenees, and in the Alps and the Sinaitic Peninsula.

THE CAUCASIAN WILD GOATS, OR TUR (*Capra cylindricornis*, etc.).

There occur in the Caucasus range three different kinds of wild goats, locally known as tur, which, as being those approaching most nearly to the sheep, naturally come first. These three kinds are commonly ranked as distinct species, but it may be a question whether they are not really only races of one species

exhibiting variations in the structure of its horns analogous to those existing in the Himalayan markhor noticed subsequently.

The goat inhabiting the Eastern Caucasus is known as Pallas's *Tur.* *Pallas's Tur.* *tur* (*C. cylindricornis*), and is found to the westward of Kasbeg and throughout Daghestan. It may be described as a goat with horns like those

of the bharal. The horns are black, smooth, and nearly cylindrical, directed outwards and backwards in a somewhat spiral manner, with their tips directed inwards, and sometimes not separated from one another by an interval of more than a foot. The general colour of the animal is light brown, and the height at the shoulder about

3 feet. The reddish brown beard is short and stiff, and curved inwards towards the middle of the chin. Another distinctive feature is to be found in the lower incisor teeth, which have very narrow crowns. Good specimens of the horns may measure some 31 inches along the curve, and occasionally reach $34\frac{1}{2}$ and 36 inches.

In the Central Caucasus, between Elburz and Daghestan, the Caucasian Tur. preceding form is replaced by the true Caucasian tur (*C. caucasica*), which is intermediate between it and Severtzow's. This tur is very similar in appearance to Pallas's, having horns with a spiral curvature, and approaching each other at the tips, but with a nearly square cross-section at the base, and with knobs on the front surface. The colour is very like that of Severtzow's tur, but the head is more reddish, the beard like that of Pallas's, and the under-part of the body darker, while the tail has longer hairs. The incisors are like those of *C. cylindricornis* and the horns vary from 30 to 40 inches in length.

Severtzow's Tur. *Severtzow's tur* (*C. severtzowi*), inhabits the whole of the Western Caucasus, and presents considerable local variation in colour. It is a very strongly-built animal, standing about 3 feet at the withers. Its general colour is brownish grey with a yellowish tinge, the head and spine being darker, the under-parts a lighter shade of brown, and the limbs dark with a pale stripe on their hinder surface. The brown beard is long and narrow, and the tail very short. The most distinctive feature of this goat is, however, found in its horns. These are very large, black in colour, and directed upwards and backwards in a scimitar-like form, curving almost entirely in a single plane, with their tips widely separated, and generally directed downwards, although occasionally outwards. The section of these horns at the base is triangular, and



HORNS OF PALLAS'S TUR.

they are ornamented in front with more or less distinct knobs, so that they are very like those of ibex, although shorter and thicker. They vary somewhat in their degree of outward inclination — being sometimes separated by as much as 3 feet at the tips—and those in which the outward inclination is most marked and the knobs most developed approach nearest to Pallas's tur. This form is further distinguished by the crowns of the lower incisor teeth being wide and rounded.

If we had only Pallas's tur and Severtzow's tur to deal with there would be no hesitation in regarding them as distinct species, but the Caucasian tur, inhabiting the intermediate area, suggests a passage from the one to the other. The habits of these goats are probably very similar to those of the next species.

THE SPANISH WILD GOAT (*Capra pyrenaica*).

Although often termed an ibex, the Spanish wild goat—the cabramontes of the Spaniards—is much more nearly allied to the turs. It is characterised by the horns of the males having an upward and outward direction, and forming a slight and very open spiral. They are flattened on the inner side and keeled behind, so as to present a pyriform cross-section. When seen from the front, as in the right-hand figure of woodcut on next page, their form is somewhat lyrate, and on their outer side they carry more or less well-marked bosses or knobs, resembling those on the front of the horns of the ibex. There is a small but thick black beard, which may be of considerable length. The general colour of the hair is light brown, but it is much darker around the nose and on the forehead and the back of the head; a triangular patch on the back, a streak on the flanks, and the front of the limbs are black; the upper lips, the cheeks, the sides of the throat, and the hinder surfaces of the legs are greyish, and the remainder of the under-parts are white. There is, however, considerable variation in colour according to the season of the year, and also a certain amount of local variation in this respect. The hair is much longer in winter than in summer, and there is a thick woolly under-fur. The height of the animal is about 26 inches at the shoulder. Horns of old rams average 24 or 25 inches, but may reach 27 or 28 inches in length.

Distribution. The Spanish wild goat inhabits the Pyrenees, some of the mountains of Central Spain, and the higher ranges of Andalusia and Portugal. That the species has existed in the southern portion of its habitat since the Pleistocene epoch is proved by the occurrence of its bones in the caves of Gibraltar, in company with those of an extinct rhinoceros.

It was at one time considered that the wild goat of Andalusia was specifically distinct from the Pyrenean form, but it is now known that the two are only varieties of a single species. It appears from the observations of Mr. A. Chapman that the variety from the Pyrenees is the largest, and is characterised by the horns of very old males tending to assume a smooth form, without distinct knobs, and thus approximating to those of the Caucasian tur. In specimens obtained from the Sierra Nevada, in Andalusia, at elevations of about eleven thousand feet, the horns are frequently as long as those of the Pyrenean variety, but they are generally more flattened, while the size of the animals themselves is considerably less. The wild goats of the Central Spanish Cordilleras are those with the heaviest and most

distinctly knobbed horns, but there is a complete transition from this type to the Pyrenean form.

Habits. During the greater portion of the year the males of the Spanish wild goat live apart from the females, and it is only during the breeding-season that the two sexes come together. Both sexes associate in flocks,



THE SPANISH WILD GOAT ($\frac{1}{2}$ nat. size)

which may be very large, comprising at times from a hundred to a hundred and fifty head. As a rule, the old bucks, heedless of snow and cold, reside on the most exposed and highest peaks of the mountains; but the does, especially in the late spring, frequent the southern slopes, and in the depth of the winter will descend even to the neighbourhood of the villages. When feeding or reposing, sentinels are placed in commanding positions to apprise the flock of approaching danger, which they do by means of a loud snort, upon which the whole company at once takes

to flight. Mr. E. N. Buxton states that these goats are generally found among thick scrub, and he considers that the incurving tips of their horns are thus formed on purpose to admit of easy passage among bushes. The pairing-season takes place in November, when the flocks of opposite sexes come together, and the males engage in combats for the possession of the females. In December the sexes again split up into separate flocks, the males from one to three years of age consorting, however, with the females. The kids are born in April or the beginning of May, from twenty to twenty-four weeks after the pairing-season, and in a few hours after birth are able to follow their mothers over the roughest ground. While the kids are young the mothers confine themselves to the southern slopes and warmer parts of the mountains, and carefully avoid such situations as are exposed to cold and cutting winds. These goats are hunted either by stalking or driving, and in either case display the extreme wariness characteristic of the group.

That the Spanish wild goat is allied to the Caucasian tur is quite evident. The form and curvature of its horns, together with the presence of a keel on their posterior border, is, however, suggestive of a transition from the type of horn obtaining in the ibex to that found in the markhor, and it is thus easy to see how all the varieties of horns found among the goats may have been derived from a single common form.

THE PERSIAN WILD GOAT (*Capra aegagrus*).

The Persian wild goat—the pasang (rock-footed) of the Persians—is a species of especial interest as being the chief ancestral stock from which the various breeds of domestic goats are derived. This species is characterised by the long scimitar-like horns of the males, which are much compressed, with the front edge forming a sharp keel, marked by irregular prominences and notches, while the hinder edge is rounded, and the outer side more convex than the inner. Generally the tips of the horns are inclined inwards, although they are occasionally divergent. The horns of the does are much smaller, with an even front edge. The male pasang has a small beard on the chin; and in the winter coat the hair on the neck and shoulders is rather longer than elsewhere; and at the same season in the colder portions of the animals' habitat a coat of woolly under-fur is developed beneath the hair. In winter the general colour of the upper-parts is brownish grey, tending in summer to yellowish or rufous brown; the under-parts and the inner sides of the buttocks being whitish or white. In the older bucks, as in the central figure of our illustration on the following page, the general colour is, however, paler; a stripe down the back, the tail, the chin, throat, and beard, the front of the legs, with the exception of the knees, and a stripe along the flanks are dark brown. There is also a certain amount of white on the lower part of the legs.

An adult male, measured by Captain Hutton, stood 37 inches at the withers. Good horns of the pasang measure 40 inches along the curve; but in one specimen killed near Karachi, the length was upwards of $52\frac{1}{2}$ inches, with a basal girth of 7 inches.

Distribution. The range of this species is extensive, and was formerly even more so than it is at the present day. There is evidence that in

classic times this goat was widely distributed over the Grecian Archipelago; although in Europe it is now found only in Crete, the island of Antimelo in the Cyclades, and perhaps also in Giura, to the north-east of Eubœa. Eastwards it is found in the hills and mountains of Asia Minor, being especially common in the Taurus range; and it extends thence through Persia into Baluchistan, Sind, and Afghanistan. In India its range does not extend beyond the western side of Sind,



THE PERSIAN WILD GOAT ($\frac{1}{2}$ nat. size).

as eastwards and north-east of the Bolan Pass and Quetta its place is taken by the markhor. Found in Sind and Baluchistan in hills little above the sea-level, in the mountains of Persia it ascends to elevations of eleven or twelve thousand feet.

Habits. The pasang is an extremely active animal, chiefly frequenting craggy and rocky districts, and taking leaps of great length with unerring precision. Although such a feat has been expressly denied by all competent authorities as occurring among the sheep, it is recorded by a trustworthy

observer, that one of these goats, which had missed its footing, saved itself by alighting on its horns. Writing of this species in Persia, St. John observes that "in spite of the constant persecution to which it is subjected, it exists in vast numbers. On the Kuh-i-barf, a not very lofty or extensive hill, constantly shot over, near Shiraz, I once counted over a hundred in a herd, which had been driven together by two days' consecutive fusilade from half a dozen shikaris. . . . The ibex," as Sir Oliver calls the animal, "is marvellously shy and wary. In my earlier residence in Persia I spent many a weary day after them, but never managed to bag a buck. Even native sportsmen, though admirable shots, and thoroughly familiar with every nook and cranny of the hills, rarely get one by fair stalking; most of those killed being obtained by building a wall of loose stones near water, and shooting the goats when drinking. The males drink in the morning and evening only, but the females, in hot weather, at least, drink also at midday. While putting up the telegraph about sixty miles north of Shiraz, in 1864, I came suddenly upon a herd of twenty or more does and kids, drinking by the roadside, a couple of hundred yards from the foot of the hills. Except when alarmed, bucks and does seem to keep apart."

In Sind and Baluchistan these goats inhabit barren rocky hills, but in parts of Asia Minor they are found on forest-clad uplands. In such localities, according to Mr. E. N. Buxton, they may often be found within hearing of the drovers on the roads, or even of the railways; but this confidence is accompanied by exceeding watchfulness. The number in a flock in these districts is generally from four to ten, and at the time of Mr. Buxton's observations bucks and does were found together. Sentinels are almost always posted to warn the flock, these being relieved at short intervals; and it appears that this sentry-duty is undertaken according to seniority, the youngest animals commencing first, and the oldest buck taking his turn last. In Asia Minor pasang are hunted both by driving and by stalking; but they are so cunning that the former method is not generally very successful. The Cabulis hunt them on the lower grounds of Afghanistan with greyhounds.

In the Caucasus the kids are born in May, but Mr. Blanford believes that in Sind they are produced somewhat earlier. There may be either one or two, and, it is said, occasionally three at a birth.

The bezoar-stone, so highly esteemed in Persia as an antidote to poison and a remedy for several diseases, is a concretion found in the stomach of the pasang, from whence it derives its old European name of Pazen, or Pasen.

In the island of Giura, near Eubœa, there occurs a wild goat
Giura Goat. which has been regarded as a distinct species, under the name of *C. dorcus*. There is, however, little doubt but that it is the descendant of tamed goats which have run wild, or of such animals crossed with the pasang.

DOMESTIC GOATS (*Capra hircus*).

It has been already mentioned that the various breeds of domesticated goat have been mainly if not exclusively derived from the Persian wild goat, and they may accordingly be most conveniently considered in this place. In saying that domestic goats are mainly derived from that species, it should, however, be men-

tioned that it is probable that many races may have been crossed with other wild kinds. Domestic goats exhibit great variety in the form of their horns; some retaining the backward scimitar-like sweep of the ancestral pasang, while others assume a spiral form recalling these of the markhor. When, however, such spiral-horned specimens are carefully examined, it will be found that the direction of the twist is precisely the opposite of that which occurs in the markhor.



ANGORA GOAT ($\frac{1}{2}$ nat. size).

The varieties of domestic goats are almost innumerable, and there is such an amount of difference between the more extreme types that it is at first sight difficult to believe that they all belong to a single species. In certain instances the horns may disappear from one or from both sexes, while in other cases those of the female are quite different from those of the male, and occasionally a second pair may be developed. Equal diversity obtains in regard to the length of the hair, which in the long-legged and pendulous-eared Indian breed is no longer than in a deer; while in the Kashmir and Angora goats it reaches nearly to the ground.

The colour, again, may vary from pure white to brownish black; and there are great differences as regards the size and shape of the body. The ears may be either upright or pendent, and when in the latter state sometimes attain an enormous length.

Angora Breed. Goats were domesticated by the prehistoric inhabitants of the Swiss lake-cities, and were likewise well known to the ancient Egyptians. Noticing only a few of the more remarkable modern races, one of the most valued is the Angora goat, a native of a district of Asia Minor, but which has been imported into several parts of Europe. It is a large species, with long, flattened, and spirally-twisted horns in the males; and has been regarded by some writers as a direct descendant of the markhor. The body is low, the legs are stout, the head and neck short, and the ears pendent. The white hair is long, wavy, and silky, and it is used in the manufacture of a peculiar kind of cloth. During the cold weather these goats are kept in stables, but throughout the rest of the year are suffered to roam at large; the flocks are very large, each buck being accompanied by about a hundred does. They are shorn in April; and during the heats of summer their hair is carefully washed and combed in order to prevent its deterioration. Some few are born without horns, and it is stated that in such cases the hair is short and close.

Kashmir Goat. Of equal celebrity with the last is the Kashmir goat, which is a rather small but strongly-built variety, characterised by the presence of a thick under-coat of wool beneath the long hair. The neck is short, the head somewhat thick, the eyes small, and the pendent ears longer than half the length of the head. The horns are long and flattened, with a sharp edge in front, and curved outwards and backwards; their tips being inclined inwards. There is considerable variation in colour; but generally the sides of the head, the upper parts of the body, and the tail are silvery or yellowish white. Some individuals are uniformly coloured throughout, and may be either pure white, yellow, light or dark brown, or even black. Although most abundant in Tibet, the Kashmir goat extends to Bokhara, and the country of the Kirghiz; while of late years it has been introduced into France, Würtemberg, and Austria. These goats are valued for their under-wool, which is combed out during the summer, and is known in Kashmir as *pashm*. From this pashm are manufactured the Kashmir shawls, and also a very fine and soft dove-coloured cloth, *pashmina*. A certain quality of pashm is also obtained from the Himalayan ibex. Enormous flocks of these goats are kept in many parts of Tibet.

Syrian Goat. The Syrian or mamber goat of Eastern Europe and South-Western Asia resembles the preceding in the length of the hair, but is distinguished from all other breeds by the extraordinary length of its pendent ears, which are half as long again as the head. These goats are of large size and very tall; the horns are usually present in both sexes, and curve in a semicircle; the profile of the face is convex; and both sexes have a small beard. The long black hair is shaggy and silky.

Egyptian Goat. The Nile or Egyptian goat is another allied breed, agreeing in size with the ordinary domestic goat, but with longer legs and shorter horns, and especially distinguished by the small size of the head and the extreme

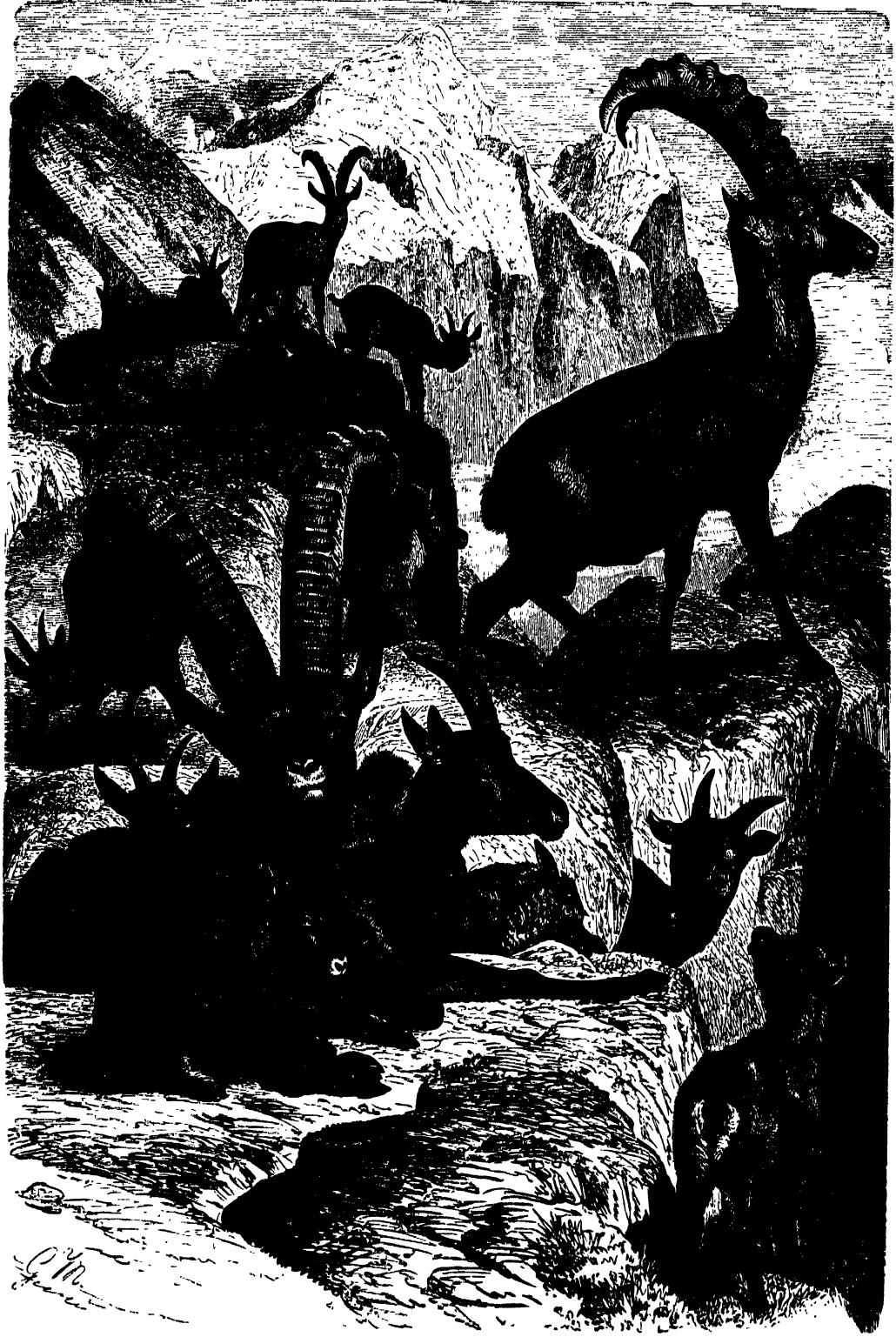
convexity of the profile. The horns are frequently absent in both sexes, and when present are short, thick, and crumpled; while there is generally no beard. The pendent ears are about as long as the head, and are rounded at the tips, and flat. The hair is short, and generally of a reddish brown colour, but inclining to yellow on the legs. Sometimes, however, the colour is slaty grey, or spotted. These goats extend from the countries along the Lower Nile to Central Nubia. The Theban race of this breed has the most marked convexity of profile.

Sudan Goat. Perhaps, however, the most remarkable of all the breeds is the Sudan goat, characterised by the short horns of 3 or 4 inches in length, curving at first backwards and outwards, and then bending forwards at their tips. The legs are short and strong; and the short but thick hair is generally dark coloured, frequently showing a mixture of black and reddish. Sometimes the general dark colour is relieved by white spots; but red, yellowish brown, and perfectly black specimens are not uncommon. From the chin depends a black beard reaching to the chest, where it divides to spread over the shoulders and upper-parts of the fore-limbs. These goats are found over all the country lying between the White Nile and the Niger, and doubtless extend over the greater part of Central Africa to the West Coast. They are kept by the natives in enormous flocks.

Feral Goats. Mention has already been made of the wild goats of the Isle of Giura, which are probably derived from a domestic race perhaps crossed with the pasang. Goats have also run wild in many other places, more especially mountainous islands like St. Helena, Tavolara near Sardinia, and Juan Fernandez. In St. Helena these wild goats have completely destroyed a large portion of the native flora, and this has resulted in the disappearance of much of the fauna. Goats were introduced by the Spaniards into Juan Fernandez in the year 1563. These soon increased enormously, and in order to diminish their numbers dogs were subsequently let loose, and likewise ran wild. At the time of Lord Anson's visit, in the summer of 1741, the goats had been greatly reduced in numbers by the dogs, and they were further so much thinned by his party that it was estimated only about two hundred remained. About thirty years ago Pechuel-Loesche visited the island, and found that while the dogs had disappeared, the goats had once more become exceedingly numerous. In 1885 the goats were being vigorously hunted by the settlers with guns and dogs. The general colour of these goats is reddish brown, in some districts spotted with dirty white.

IBEX (*Capra ibex*, etc.).

Although the Spanish and Persian wild goats are frequently spoken of as ibex, it seems preferable to restrict this term to four nearly-allied species, namely, the true or Alpine ibex, the Himalayan ibex, the Arabian ibex, and the Abyssinian ibex. All these species are characterised by their nearly uniform coloration, and by the front surface of their long scimitar-shaped horns being flattened and ornamented by a number of bold transverse knots or ridges. These horns curve backwards, and diverge regularly, although in some cases their tips have an inward inclination; they are nearly triangular in cross-section, the base of the



ALPINE IBEX.

triangle being formed by the broad front surface, and the apex by the sharp hinder edge. In the females the horns are small and placed wider apart at the base, with a nearly oval section, and they are marked by parallel wrinkles.

The Alpine ibex, steinbok, or bouquetin (*C. ibex*), is now **Alpine Ibex.** exterminated as a wild animal, although preserved by the Italian Government in one or two valleys on the Piedmont side of Monte Rosa. It is readily distinguished from the Himalayan ibex by the extremely small size of the beard of the males, which is so short as to be scarcely noticeable. The animal is also of smaller size, and at the present day, at least, its horns are far shorter, and have less prominent knobs than those of the Himalayan species. Doubtless, however, the general size of the animal, as well as the length of its horns, have been considerably reduced by the circumscribed area to which it is now confined. Formerly, indeed, the ibex roamed over the Alps of Savoy, Switzerland, and the Tyrol; but it is unfortunate that there do not appear to be records of the length to which the horns formerly attained. Horns of $26\frac{3}{4}$ and $31\frac{3}{4}$ inches in length have, however, been recorded of late years.

The pairing-season is in January, and the kids are born at the end of June or beginning of July. The habits of this species are practically identical with those of the Himalayan ibex.

Himalayan Ibex. The Himalayan ibex (*C. sibirica*) differs from the Alpine species by the presence of a profuse beard on the chin of the bucks, and a ridge of coarse dark hair along the back, as well as by its superior size and longer horns. The hair is coarse and brittle; and in winter is underlain by a thick coat of wool, or pashm, which enables the animal to withstand the intense cold of its native mountains. The horns of the bucks have very large knobs, placed at fairly regular intervals; and it may be observed here that these knobs do not indicate the annual stages of growth, which are marked by fine lines on the sides of the horns. In colour the Himalayan ibex is subject to a considerable amount of seasonal and local variation. Generally, however, in summer the colour is brown, only slightly paler above than below; but old males have some dirty white patches on the back. On the other hand, in winter the coat assumes a yellowish white hue, more or less tinged with brown or grey. The dark line on the back has been already mentioned, and in addition to this the beard, tail, and legs are also dark brown. In Baltistan very dark-coloured ibex are met with; and specimens from Siberia and the Thian Shan range are distinguished by having the under surface of the hinder-part of the body and portions of the legs entirely white.

A well-grown buck of the Himalayan ibex will stand about 40 inches at the shoulder; while does are about a third smaller. Fine specimens of the horns measure from 40 to 45 inches along the curve; but a pair have been recorded measuring upwards of 54 inches in length, with a girth of $11\frac{1}{2}$ inches just above the first knob; and there are several of 51 inches, or a little over, in existence.

Distribution. Assuming the ibex of the Himalaya to be identical with the one inhabiting the Thian Shan range and Siberia, the species has a very extensive geographical range. Thus, it is found in all the mountain ranges of Central Asia, from the Himalaya to the Altai, and from the neighbourhood of

Herat, on the Persian frontier, in the north-west, to Kumaon in the south-east. It is found not only on the crags but likewise on the open Pamir country. To the south of the Valley of Kashmir the ibex is unknown in the Pir Panjal range, and its continuation to the north-west of the Jhelam river, the Kajnag; but it is not known to occur in the Himalaya to the eastward of the sources of the Ganges, neither is it recorded from Eastern Tibet. Messrs. Blanford and Hodgson have, however, reason to believe that it occurs in Tibet to the northwards of Shikatse, on the Sampo river, and also near Lhasa.

Habits. Like its Alpine cousin, the Himalayan ibex inhabits the crags and upland meadows at or near the snow-level, rising or descending according to the season of the year. General Macintyre writes of the habits of



HEAD OF HIMALAYAN IBEX.

this species, in the following words:—"From what I have seen and heard of ibex, their sense of smell is not nearly so acute as their sight. But they seldom apprehend danger from above, so it is best to approach them, if possible, from that direction. During the spring and early summer they may be seen feeding at almost any time of the day on the green patches of herbage among the higher crags and snow-fields, only taking a siesta for a few hours at a time. In the dead of winter they are found much lower on the mountain-sides. Provided they do not see the hunter, they are not always scared away by firing, probably owing to their being so accustomed to hearing the noise of falling rocks and

avalanches. And sometimes they get so bewildered by the echoes of a shot, that they give time for several easy chances before making up their minds to be off. If one of them, however, catches only a glimpse of anything suspicious, a warning whistle at once sends off the whole herd, although they often depart very leisurely, even after being shot at. Ibex sometimes congregate in large numbers, but they are usually found in flocks of from six or seven to twenty or so, the older bucks often herding separately, except during the rutting-season. Despite the quantities that are shot, killed by avalanches, and by those terrible foes to all Himalayan game, the wild dogs, there appears to be little decrease in their numbers on the more sequestered hunting-grounds; for they are very prolific, each doe having as

a rule a pair of kids every summer. The villagers train their dogs to hunt them down, when the ibex become so stupefied with terror that they are easily approached and shot."

The foregoing account refers to the habits of this ibex in the Kashmir district, and it accords in the main with an earlier one from the pen of General Kinloch. The latter writer states that ibex but seldom come as low as the upper limits of forest; and even during the winter "do not, as a rule, descend very low, but resort to places where, from the steepness of the hillside, the snow does not lie in any quantity. Here they may be detained for weeks by a heavy fall, picking a scanty subsistence from the scattered tufts of withered herbage that here and there crop out of the crevices of the rocks. At this season males and females herd together; but as the snow melts and the time for the birth of the young approaches, the old males forsake the females altogether, and, as the summer advances, retire to the most inaccessible mountains, frequently sleeping during the day above the limits of vegetation, and descending great distances to feed in the mornings and evenings. The best time to shoot ibex is when the young grass is just beginning to sprout along the margin of the snow in May and June; after the hardships and frequent long fasts of winter they feed greedily on the fresh young shoots, and in secluded spots may be found lying down on the grassy slopes during the day."

The same writer proceeds to observe that, although excessively wary, the Himalayan ibex, on account of the broken nature of the ground it frequents, is not very difficult to approach within shooting distance. From our own personal observation and the accounts of the natives of the secluded valleys around



ARABIAN IBEX.

Kashmir, we are inclined to believe that the Himalayan ibex is in the habit of descending to lower levels than is admitted by General Kinloch; and we have been told that in the valleys of Wardwan and Tibet numbers are killed at this season in the snow quite close to the villages. On one occasion, during the summer, we observed a small flock of ibex driven down from the heights by a sudden snowstorm to the level of the high-road between Kashmir and Ladak, in the valley of the Indus. In 1854 Colonel Markham wrote that in Kashmir ibex might be seen in flocks of a hundred or more, but nothing like these numbers are found at the present day; and, in spite of the statement of General Macintyre, it appears to us that in the immediate neighbourhood of Kashmir this magnificent animal is becoming rapidly scarcer.

The bucks descend from the higher crags to join the does about October, the pairing-season taking place during the winter; and the young are born in May and June, or about a month earlier than is the case with the Alpine species. To the natives of Kashmir the ibex is known as the kel, while in Baltistan and Ladak it is termed skin, or iskin.

The third representative of the group is the Arabian or Sinaitic **Arabian Ibex** ibex (*C. sinaitica*), locally known as the beden. This goat is found in the Sinaitic Peninsula, in portions of Palestine, and in Upper Egypt; it is common in Arabia Petraea, but more rare in Palestine proper, and never appears to have extended northwards of the Lebanon, where a few still remain. In Egypt its southern limit is approximately marked by the tropic of Capricorn. This species is distinguished from the Himalayan ibex by the horns being more compressed, and having the knobs on the front surface arranged at less regular intervals. The general colour of the fur is yellowish brown, with dark markings on the back, chest, and front of the legs; the under-parts and the hinder-surface of the limbs being whitish. In well-grown adult males the horns may attain a length of 36 inches along the curve, and Sir E. G. Loder has a pair almost 39 inches in length. The habits of the animal appear to be similar to those of the others.

Abyssinian Ibex. Lastly, there is the little-known Abyssinian ibex (*C. walie*), from Abyssinia, distinguished from the others by the curvature of its horns, and the presence of a protuberance in the middle of the forehead.

THE MARKHOR (*C. falconeri*).

The Himalayan markhor (literally snake-eater), or spiral-horned goat, brings us to the last representative of the genus *Capra*, and one distinguished from all the others by its upwardly-directed and spirally-twisted horns, and also by the extension of the beard on to the chest and shoulders. In the latter respect this species reminds us of the arui among the sheep, although the markhor agrees with other goats in the shortness of its tail. The markhor is further remarkable for the enormous amount of variation in the form and size of the horns; one variety having them twisted in the form of a corkscrew, with not more than one and a half complete turns, while in another they are twisted on their own axis in the form of a screw, which may have as many as three complete turns. These varieties were formerly regarded as constituting distinct species, but since they are more or

less completely connected by intermediate forms like those represented in our illustrations, they are now generally regarded as the extreme developments of one very variable species. The horns of the varieties with a corkscrew-like twist are the finest trophies yielded by any of the goats.

According to General Kinloch, the male markhor may stand nearly 3 feet 8 inches at the withers, although an adult Gilgit specimen, measured by Col. J.



THE MARKHOR, CABUL VARIETY ($\frac{1}{2}$ nat. size).

Biddulph, measured only 3 feet $2\frac{1}{2}$ inches. The magnificent beard, extending in the adult males on to the chest and shoulders, and sometimes reaching nearly to the knees, is black in front and grey behind; in the young bucks and the does at all ages it is confined to the chin. The fur has but little or no pashm, and in summer is of a reddish brown colour, but becomes grey in winter; it is paler on the under-parts, and the lower portions of the front of the legs have a dark stripe. In summer the very old males become whitish all over; while the young are uniformly greyish brown, except for a dark stripe along the back. Owing to the

variation of the horns in the different races, it is somewhat difficult to give a description which will hold good for them all. They are, however, much compressed, placed close together at the base, and spirally twisted, with a keel both in front and behind. The front keel, which tends to become rounded in old animals, at first turns outwards in each horn; and the sharp back keel twists forwards to form the prominent front ridge of the first turn of the spiral. The length varies greatly in the different races. The females have small horns with a slight twist.

Distribution. The markhor is first met with in the Pir Panjal range, forming the outer boundary of the valley of Kashmir, but does not extend to the eastwards of the valley of the Chinab river. To the north and north-west of the valley of Kashmir it extends into the districts of Baltistan, Astor, and Gilgit; and it is also found in many of the ranges of Hazara and Afghanistan, and likewise in the neighbourhood of Quetta.

Varieties. Four distinct varieties of the markhor are recognised by Mr. Blanford, and are characterised as follows:—First of all, we have the typical Astor and Baltistan markhor, in which the horns form a very open spiral, never forming more than one and a half turns. The horns are extremely massive, and attain a great length. Mr. Otho Shaw has specimens measuring 49 and 55 inches in length along the posterior keel; and it is probable that an example with a length of 63 inches belonged to this variety. Next we have the Pir Panjal markhor, of which the horns are represented in the woodcut on the next page. Here the spiral is less open, and may form from one to two complete turns. This race extends across the Jhelam river into the Kajnag range, and from thence probably into Hazara and Gilgit, where it passes into the third variety. Mr. Shaw has a pair of horns measuring 45 inches along the curve, and others have been recorded of 50 inches and rather over. In the third or Cabul variety, which is the one represented in our first illustration, the horns are almost straight, but still have a slight spiral, with two complete twists. Specimens have been measured with a length of 44 inches, but it is said that as much as 60 inches have been recorded, measured along the curve. Lastly, we have the markhor of the Suliman range, on the eastern frontier of Afghanistan, in which the horns are generally perfectly straight, with the front and back keels wound round in a sharp spiral, which may form from two to three and a half complete turns. In the largest recorded head the length along the hind keel was 49 inches. This variety is considerably inferior in size to the other, and has a smaller beard.

Habits. The different varieties of the markhor exhibit some diversity in their habits, owing to the varying nature of their native districts; General Kinloch remarking that while the open-horned varieties inhabit lofty pine-clad ranges, whose summits are generally wreathed in snow, the straight-horned Suliman race has its home among barren and rocky hills of trifling elevation, where the heat during the summer months is frequently intense.

Like other goats, markhor go in small flocks, the males generally keeping apart from the females. General Kinloch remarks of the male that "his flowing black beard, and long shaggy mane, falling from his neck and shoulders to his knees, give him a most imposing appearance; and as he stands to gaze on some jutting rock on the face of a rugged precipice, overhung by dark pine trees, no

sportsman nor lover of nature can fail to be struck with admiration at his noble bearing. He is powerfully and compactly made, and, in spite of his weight, he has perhaps no equal in traversing difficult and dangerous ground. I know of no animal whose pursuit habitually entails so much difficult climbing, and to be successful one must occasionally venture into places where no less inducement would tempt one to run the risk. Old male markhor are extremely difficult to find, especially where they have been frequently disturbed. Unlike the ibex, which keeps to the rugged crags and steep ravines above the limits of the forest, the markhor delights in rocky forests, and although it occasionally comes out into the open glades, it seeks concealment as much as possible."

This description applies to the markhor of Kashmir and Astor; but in Afghanistan the animal inhabits bare and rugged hillsides, owing to the general absence of forest in that country. The ground haunted by markhor in many parts of Kashmir territory is of the most loose and rotten description, which renders stalking decidedly dangerous. Not unfrequently markhor are found with one or both horns much broken, but whether this is due to accidents from landslips and avalanches, or to combats between one another, does not appear to be ascertained. As already mentioned, the Suliman markhor is frequently found at a comparatively low elevation; and it appears that in all localities this goat does not bear extreme cold so bravely as its cousin the ibex, and that in winter it always descends to the more protected valleys. This sensitiveness to cold is doubtless correctly attributed by Colonel Biddulph to the absence of under-fur, or pashm, in the markhor.

The agile habits of this goat were well exhibited by a buck formerly kept in the London Zoological Gardens, which, in spite of the weight of a heavy chain, was found nearly every morning mounted on the top of the high wall surrounding his enclosure. In captivity markhor breed freely, the number of young at a birth being either one or two. It does not appear to be ascertained when the young are born in the Pir Panjal range, but in the districts of Astor and Gilgit they are produced in May and June. Markhor have frequently interbred with domestic goats; and it was formerly considered that the spiral-horned varieties of the latter traced their parentage directly to this species. In domestic goats, as



HEAD OF MARKHOR; PIR PANJAL VARIETY.

already mentioned, the horns are almost invariably twisted in the opposite direction to those of the markhor, although Mr. Blanford states that there are occasionally exceptions. It is, however, not improbable that some races of domestic goats may have a larger or smaller proportion of markhor blood.

The markhor appears to be one of the oldest types of wild goat, since a fossil species, which cannot at present be satisfactorily distinguished from the living one, occurs in the Pliocene rocks of the Siwalik hills at the foot of the Himalaya.

THE TAHR AND THE NILGIRI GOAT.

Genus *Hemitragus*.

The Himalayan goat, known as the tahr (*H. jemlaicus*), together with an allied species from Arabia, and a third from the Nilgiri hills of Southern India, differ so markedly from the true goats that Mr. Blanford considers they should be placed in a genus by themselves. All these goats are utterly devoid of a beard, and also distinguished by having the extremity of the muzzle naked. Their skulls are longer and narrower than in the true goats, with the sockets of the eyes less prominent; and the horns are relatively short, and but little smaller in the does than in the bucks. In form the horns are compressed and angulated in front, with their bases quite close together; and they curve backwards from the plane of the forehead. Neither of the species have glands in the fore-feet.

Tahr. The Himalayan tahr, which is represented in our illustration, is

readily distinguished by the form of the black horns, which have their lateral surfaces flattened and shelving regularly up to the sharp and beaded keel on the inner front border; they diverge regularly from their bases, at the same time curving sharply backwards, with a slight inward inclination at the tips. On the head the hair is short, but it becomes longer on the body, and in old bucks is so lengthened on the neck, chest, and shoulders as to form a long shaggy mane reaching below the knees. There is considerable individual variation in colour, but the general tint of the hair is dark or reddish brown; old males being generally very dark, although pale-coloured individuals of both sexes are not unfrequently met with. The face and the front of the limbs are very dark, in some instances almost black; and old males have an indistinct dark line down the middle of the back. In young animals the colour is a uniform greyish brown; and the kids are reported to be very pale coloured. The female tahr differs from all other goats, as well as from sheep, in having four teats.

In height the male tahr varies from 3 feet to 3 feet 4 inches at the shoulder; the does being much smaller. Good specimens of the horns vary from 12 to 15 inches in length, measured along the curve; but a pair has been recorded with a length of 16½ and a basal girth of 10½ inches. In the does the length of the horns is seldom more than 10 inches.

Distribution. This goat is found throughout the higher forest-regions of the Himalaya, from the Pir Panjal range on the outer side of the valley of Kashmir in the north-west to Sikkim in the south-east, but is unknown in the arid Tibetan districts of the interior. Tahr is the native name by which it is

known in the Western Himalaya, but in Kashmir it is termed kras, while in Nipal it goes by the name of jharal. Quite recently a second smaller species, with only two teats, has been discovered in Arabia; while a fossil tahr occurs in the rocks of the Siwalik Hills at the foot of the Himalaya.

In spite of the small size of its horns, the tahr is decidedly a fine-
Habits. looking animal; and it is plentifully distributed over many parts of the Himalaya. Although in the Pir Panjal range tahr are often found on the same ground as markhor, in other districts they frequent almost worse ground, and we



THE HIMALAYAN TAHR ($\frac{1}{3}$ nat. size).

have known many instances where specimens have been completely smashed by falling down precipices after they were killed. After mentioning that the tahr resembles the markhor in its forest-loving habits, General Kinloch observes that "although it sometimes resorts to the rocky summits of the hills, it generally prefers the steep slopes which are more or less clothed with trees. Female tahr may frequently be found on open ground, but old males hide a great deal in the thickest jungle, lying during the heat of the day under the shade of trees or over-hanging rocks. Nearly perpendicular hills with dangerous precipices, where the forest consists of oak and ringal-cane, are the favourite haunts of the old tahr, who

climb with ease over ground where one would hardly imagine that any animal could find a footing."

The old male tahr generally herd separately from the females during the summer, but about October the two sexes come together; and it is believed that the kids are born in June and July, only a single one being produced at a birth.

The Nilgiri wild goat (*H. hylocrius*)—the warri-atu of the

Nilgiri Goat. Tamils, and the Nilgiri ibex of English sportsmen—is a southern species inhabiting the Nilgiri and Anamalai Hills, and the so-called Western Ghats as far south as Cape Comorin. It is generally found at elevations of from four thousand to six thousand feet above the sea, but occasionally somewhat lower down. This species may be distinguished at a glance from the tahr by the form of the horns, and the absence of the shaggy mane which forms such a conspicuous feature on the fore-quarters of the males of the latter. Instead of being flattened externally, the horns of this goat have their outer side highly convex, and thus have a distinct anterior surface, internally to which there is a slight ridge; moreover, for some distance the two horns run parallel to one another, after which they diverge gradually. The hair is short, thick, and coarse; the males having a short, stiff mane on the back of the neck and withers. The general colour is dark yellowish brown above, with a darker stripe down the back; while the under-parts are paler. The females and young show a more or less decided grey tinge. In height old males of the Nilgiri goat stand from $3\frac{1}{4}$ feet to $3\frac{1}{2}$ feet at the shoulder; the horns measuring from 12 to 16 inches in length along the curve, although in one instance a length of 17 inches has been recorded.

Writing of the habits of this species, Mr. Blanford observes that "the Nilgiri goat is found usually in herds of from five or six to fifty or sixty amongst the crags and rocky precipices that border the Nilgiris and other high ranges in the extreme south of India. It keeps above the forest, and but rarely enters woods. I have more than once seen these animals feeding on the grassy hills at the top of the Kundahs west of the Nilgiris, but their usual haunts are the grassy slopes and precipitous crags on the edges of the plateau; they feed on the former in the mornings and evenings, and rest on ledges amongst the cliffs during the day. They are quite as wary and sharp-sighted as tahr or markhor, and just as nimble and alert on precipitous ground. An old doe, as with other goats, usually acts as sentinel to the herd, and they always appear to suspect danger from below and not from above." The young appear to be born almost at any season of the year; and it is stated that there are generally two at a birth.

How this species originally reached its present habitat, so remote from that of its allies, is not very easy to understand; but the occurrence of a fossil goat apparently allied to this group in Perim Island, in the Gulf of Cambay, may eventually aid in solving the problem.

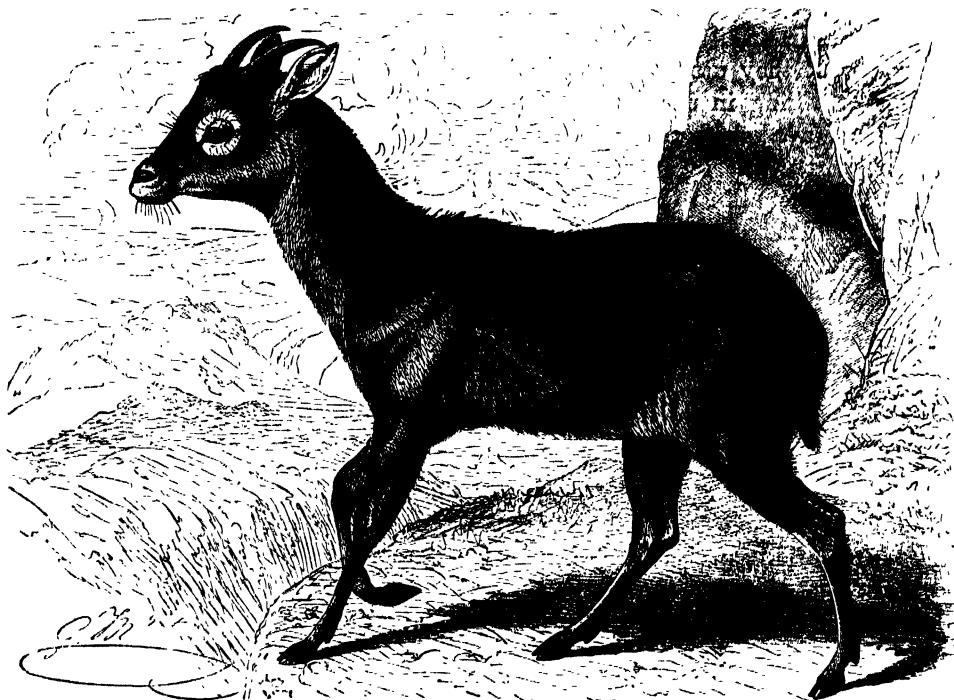
In regard to the present distribution of this goat, a recent writer observes that it is still fairly abundant on the Anamalai and Travancore Hills; but has sadly decreased elsewhere owing to the war of extermination waged against it by the native pot-hunter and European shooter, who have alike been indefatigable in slaying the does and young all seasons of the year. The ibex, as it has been locally misnamed, has become so scarce on the Nilgiris that its destruction has

been wholly prohibited since last year, but it is feared that this prohibition has been effected too late to prevent the extinction of the few now left, for the leopards are most deadly and persistent enemies, and it is a very difficult matter for a small herd to hold its own and increase in spite of their depredations.

THE GORALS.

Genus *Cemas*.

The goral (*Cemas goral*) of the Himalaya is our first representative of an assemblage of mountain-haunting Ruminants which to a great extent connect the goats with the antelopes. Most of these animals have a more or less goat-like build,



THE GORAL ($\frac{1}{5}$ nat. size).

goat-like teeth, short tails, relatively small cylindrical horns, and no beards. The goral is a relatively small creature, standing only 27 inches at the shoulder, and having somewhat stout limbs, and rather coarse short hair, which becomes elongated into a slight crest along the back of the neck. Its general colour is brown, with a more or less rufous or grey tinge; but there is a dark stripe from the nape of the neck to the black tail, and another down the front of each leg, while the throat is white. The muzzle is naked; and the face, as in the goats, has no gland below the eye, while the skull lacks any depression in the same region. The short, black, and conical horns curve regularly backwards, and are marked, except at the tip, by a number of small and irregular rings. In the bucks they may vary

from 6 to 8 inches in length, but a pair has been recorded of upwards of 9½ inches. The horns of the does are only slightly smaller than those of the bucks.

Distribution. The goral is found throughout the outer ridges of the Himalaya, from Kashmir to Bhutan, at elevations of from three thousand to eight thousand feet. In Eastern Tibet its place is taken by the ashy goral (*C. cinerea*) and the grey goral (*C. grisea*); while in Northern China and Amurland it is represented by the long-tailed goral, distinguished by its longer tail.

Habits. The Himalayan goral is generally found in small parties of from four to eight individuals; but sometimes these animals associate only in pairs, and old bucks appear to be generally solitary. They frequent rugged grassy hills or rocky forest-clad ground; and during cloudy weather feed throughout the day, but when fine, only in the morning and evening. Where one goral is seen, there others will almost certainly be found in the neighbourhood; and these animals but rarely forsake their feeding-grounds. When alarmed, they utter a kind of hissing snort. General Macintyre writes that "goral-stalking in the precipitous and broken ground on the middle ranges [of the Himalaya], is perhaps the pleasantest though not the grandest kind of mountain sport. The amount of stiff climbing it entails is quite enough to give it zest, without making it excessively laborious. The sportsman can generally return to his tent to rest during the heat of the day, whilst the goral are doing likewise, hidden away among the shady recesses of the rocks, and he can always get back at night to a comfortable bed."

THE SEROWS.

Genus *Nemorhaedus*.

Nearly allied to the gorals are the more shaggy animals known as serows, or goat-antelopes, which are likewise peculiar to South-Eastern and Eastern Asia. Although resembling the gorals in their general build, their naked muzzles, short tails, and the presence of four teats in the females, the serows are distinguished by having a gland beneath the eye, and a corresponding shallow depression in the skull for its reception. Moreover, the plane of the forehead passes imperceptibly into that of the region behind the horns, whereas in the gorals the two are separated by a distinct angle.

The common serow (*Nemorhaedus bubalinus*) is a Himalayan species extending from Kashmir to the Mishni Hills, where it is found at elevations of from six to twelve thousand feet. It is much larger than the goral, standing about 37 inches at the shoulders, and the horns of bucks generally measuring from 9 to 10 inches in length, although they may reach as much as 13½ inches. The serow is rather an ugly-looking animal, with large ears, and coarse and somewhat thin hair of moderate length, which forms a kind of crest along the neck. The head and neck are black, and the rest of the hair of the upper-parts black or dark grey, with a more or less distinct grizzle; the muzzle, chin, and inside of the ears are white, and the under-parts are also whitish, while the flanks, chest, etc., are rusty red. The black horns curve regularly backwards, and, in addition to

numerous rings, are marked by a number of longitudinal striæ. The two sexes are very similar.

The Burnese serow (*N. sumatrensis*), which inhabits hilly districts from the Eastern Himalaya to Yunnan and Eastern Tibet, and thence to Siam, Burma, the Malay Peninsula, and Sumatra, is only distinguished by its redder colour, and perhaps rather smaller size. The other two species are the Japanese serow (*N. crispus*) from Japan, and Swinhoe's serow (*N. swinhoei*) from the island of Formosa; both of which are distinguished by their smaller size, which is about equal to that of the goral.

Habits. The habits of all the serows are probably very similar. Writing

of the Himalayan species, General Kinloch observes that it "has an awkward gait, but, in spite of this, it can go over the worst ground; and it has, perhaps, no superior in going down steep hills. It is a solitary animal, and is nowhere numerous; two or three may be found on one hill, four or five on another, and so on. It delights in the steepest and most rocky hillsides, and its favourite resting-places are in caves, under the shelter of overhanging rocks, or at the foot of shady trees. Although very shy and difficult to find, the serow is a fierce and dangerous animal when brought to bay. I have even heard of an unwounded male charging when his mate had been shot. It is said that a serow will sometimes beat off a pack of wild dogs, and I believe that serow and dogs have been found lying dead together. When disturbed, the serow utters a most singular sound, something between a snort and a screaming whistle, and I have heard them screaming loudly when they had apparently not been alarmed." General Macintyre relates that on one occasion "a female serow had been shot by a sportsman, when, on his native follower approaching to secure it, a male companion rushed out from the dense cover hard by, and, going for the man, sent him rolling downhill with a butt from its horns."



HORNS OF HIMALAYAN SEROW.

THE TAKIN.

Genus *Budorcas*.

One of the most remarkable members of this group is the little-known takin (*Budorcas taxicolor*), from Eastern Tibet and the Mishmi Hills, which is evidently allied to the serow, although with very differently shaped horns. The takin is a heavily-built and comparatively large animal, standing $3\frac{1}{2}$ feet at the shoulder, with stout limbs, large lateral hoofs, and a small goat-like tail. The muzzle is

covered with hair, except a small spot at the extremity; and the profile of the face is convex. The horns are black and thick in both sexes; in the males they rise

(as in our figure) close together, and at first curve outwards, after which they make a sharp turn and are directed straight backwards. According to Mr. A. O. Hume, the horns of the female are placed further apart at the base, and curve outwards and then backwards without any marked angulation; but other writers state that they are similar in shape to those of the males, but smaller and thinner. Male horns vary in length from 20 to 24 inches, with a basal girth of 9 or 10 inches. The head of the takin is black, but the colour of the coarse hair

of the body varies from yellowish to reddish brown mingled with black. Very little is known of the habits of this Tibetan ruminant, but it appears to be found either singly or in herds.



UPPER PART OF SKULL AND HORMS OF MALE TAKIN.
(From Hume, Proc. Zool. Soc., 1887.)

THE ROCKY MOUNTAIN GOAT.

Genus *Haploceros*.

The so-called goat of the Rocky Mountains (*Haploceros montanus*), which is the third and last representative of the *Bovidae* inhabiting America, is another animal nearly allied to the serow. This creature is about the size of a large sheep, and averages 100 lbs. in weight. It has very short and stout legs, terminating in broad and blunted hoofs, pointed ears, and jet black horns, curving backwards, and ringed for about half their length, but smooth above this. The body is covered with a long coat of white hair, which is nearly straight, and falls on the sides of the body and limbs, but is erect along the middle of the back, and as it becomes longer over the withers and haunches the animal looks as though it had two humps. Beneath the hair there is a thick coat of wool. There are no glands below the eyes. In length the horns vary from 6 to 10½ inches; and the skeleton is remarkable for the extreme shortness of the cannon-bones.

Distribution. The range of this animal extends through the Rocky Mountains from about lat. 36° in California at least as far north as lat. 62°, but Mr. J. Fannin believes that it will be found as far north as the mountains reach. The same writer observes that it "is extremely abundant in British Columbia, ranging from its southern boundary to the watershed of the Arctic Ocean, and from the coast-line to the Rockies. Here, amid nature's wildest scenes,

amid storm-swept cañons and beetling crags, amid steel-blue glaciers and snowy peaks, where the silence is seldom broken save by the rush of mountain torrent, the howling of the storm, or the crashing of the treacherous avalanche,—here, far removed from the trail of the ordinary hunter, the mountain-goat, solitary in its habits, and contented with its chaotic and gloomy surroundings, increases and multiplies.”

Habits. Although chiefly a mountain animal, this species is occasionally

observed close to the sea-level, and has even been seen swimming salt-water estuaries or rivers. Such occurrences are, however, rare; and, as a rule, the Rocky Mountain goat lives above or close to the upper limits of forests. But when driven by hunger, these animals sometimes descend to lower levels in the forest, while they will not unfrequently traverse the lowlands separating one mountain or range from another. During the pairing-season in November and in the middle of winter they are gregarious, although not markedly so at other seasons of the year. As might be inferred, from their short and clumsy limbs, these animals have but little speed; and when disturbed they move leisurely off, trusting rather to concealment behind sheltering rocks than in rapidity of pace. Formerly the Rocky Mountain goat was much hunted by the Indians for the sake of its fleece, but now that the demand for blankets made from its wool has well-nigh ceased, the pursuit itself has been abandoned in many districts.

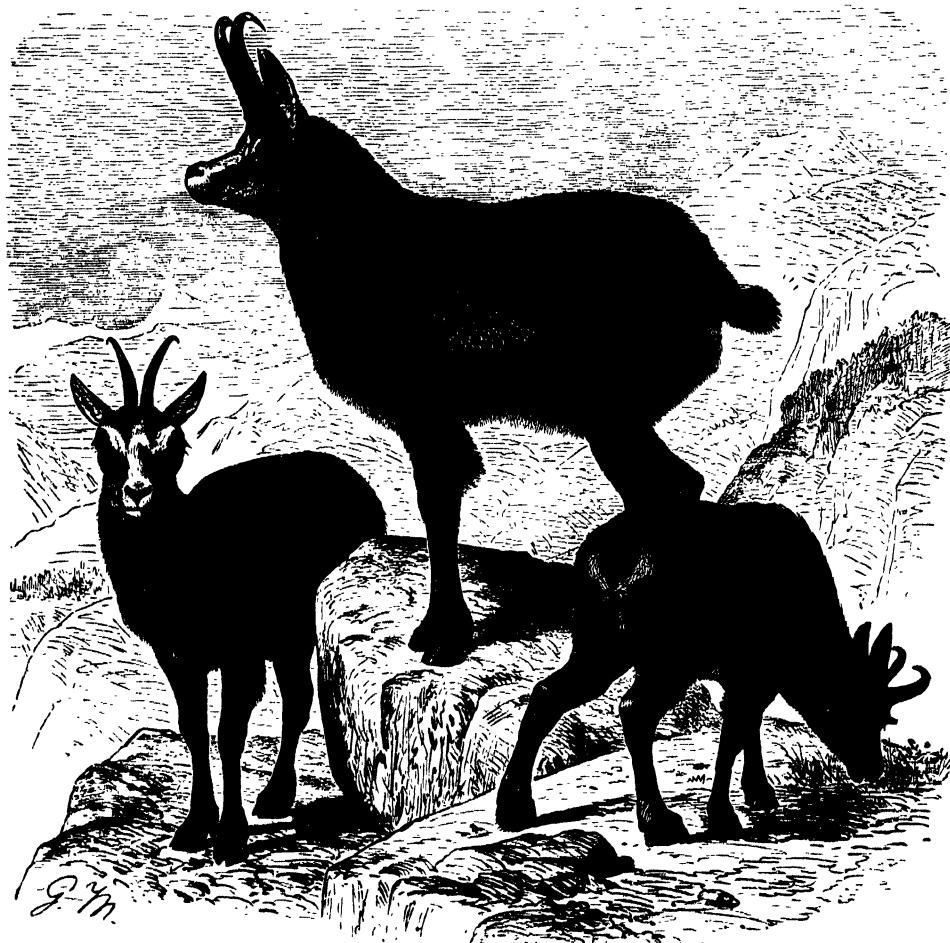
Although extremely agile among its native mountains, the Rocky Mountain goat, in spite of many statements to the contrary, does not appear to be a very wary animal. Indeed, Mr. Fannin states that it is, perhaps, the most stupid animal in the mountains, and little or no skill is required in hunting it. The great difficulty is in reaching the almost inaccessible places which it usually inhabits. The best time for hunting is in September and October, before the rainy season sets in, although the skins are not in their best condition till later on. In coloration this animal is unique among Ruminants; and is, indeed, one of the few mammals that are white at all seasons. Its white coat is admirably adapted to harmonise with the snows of its highest haunts, but would seem to be conspicuous when the animal is among dark rocks or on its grazing-grounds.

THE CHAMOIS.

Genus *Rupicapra*.

The last representative of the goat-like antelopes is the well-known chamois or gemse (*Rupicapra tragus*), of the mountains of Europe, readily distinguished from all the others by the short and cylindrical black horns rising for a considerable distance vertically from the forehead, and then bending sharply backwards and downwards in a hook-like manner. The chamois is a strongly-built animal, with relatively long and stout limbs, and a very short stumpy tail; in height it stands about 2 feet at the withers. The hair is close and rather long, with a thick woolly under-fur. During the winter the general colour is a chestnut-brown, paler on the face and under-parts, and there is a well-marked brown streak extending from below the eye nearly to the corner of the mouth; the tail being black. In

the summer the coat is lighter coloured, having in spring a more or less marked grey hue. The erect ears are sharply pointed; and the horns, except at their tips, are marked both by slight transverse rings and by longitudinal striae. Fair-sized horns are about 7 inches in length, but some specimens measure as much as 9 inches, or rather more, while a few reach $10\frac{1}{4}$ inches. The weight of a buck chamois may vary from 50 to 70 lbs. Light-coloured, or even white varieties, are



THE CHAMOIS ($\frac{1}{2}$ nat. size).

occasionally met with. The face has a small gland below the eye, and there is a corresponding shallow depression in the skull for its reception; while the muzzle is completely covered with hair. The hoofs have their outer edges higher than the central portion, and are thus adapted for securing a firm foothold on rocks.

Distribution. The chamois has a wide distribution in the mountains of Europe, occurring in the Pyrenees (where it is known as the *izard*), the mountains of the coast of Spain, in Dalmatia and Greece, in the Carpathians, the



CHAMOIS AT BAY.

Swiss and Transylvanian Alps, the Caucasus, the Taurus Range, and in the mountains of Georgia. The Pyrenean izard is a smaller form, with shorter horns and a more foxy-red colour than the typical Alpine gemse; and the variety found in the Caucasus, where it is known as atchi, has also certain distinctive differences. Neither of these can, however, be regarded as more than local races. At the present day the chamois has become rare in the Swiss Alps, but in the Eastern Alps, in the districts of Bavaria, Salzburg, Styria, and Carinthia, it is far more common; while it is abundant on the precipitous summits of the central Carpathians. Fossil remains of the chamois are found in caverns at low elevations in several parts of the European continent, thus indicating very different climatic conditions from those now prevailing.

Habits. As regards its habits, the general notion is that the chamois is

an essentially Alpine animal; that is, one frequenting the glaciers and snowy peaks above the forest-level. This, however, according to Brehm, is a mistaken idea; the truth being that the chamois is really a forest-dwelling animal, and that most individuals of the species live from year's end to year's end within the limits of the forest. A certain number during the summer always leave, however, the main flock, to take up their abode for a period of weeks or months among the glaciers and snow-fields above the upper limits of forests. These adventurous individuals are known to the hunters as glacier-chamois, in contradistinction to wood-chamois; but a short spell of severe weather is sufficient to drive even these back to the shelter of the forests. The favourite haunts of the chamois are the western and north-western slopes of the Alps in summer; while in the winter they prefer the spots with an easterly or southerly aspect.

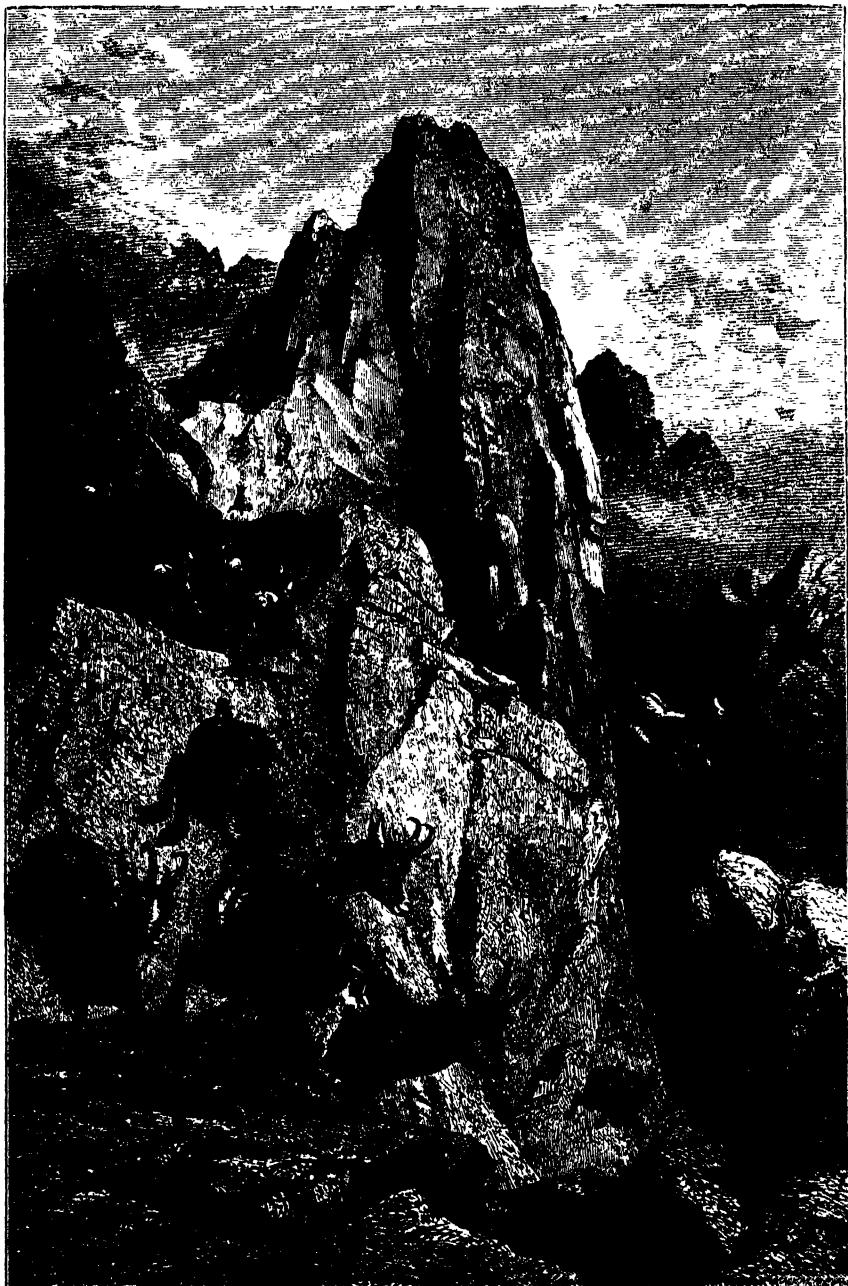
Chamois are essentially gregarious animals, usually associating together in herds of fifteen or twenty individuals. They repose during the night, but with the first glimmer of dawn commence feeding; towards the middle of the day they again seek the shelter of rocks or trees, where they lie in the shade till evening, when they once more issue forth to feed.

Their chief nutriment consists of lichens and the scanty mountain herbage. During the greater part of the year the old males live a solitary life apart from the flocks; but during the pairing-season in October and November they join the flocks of females, from which they drive away the young bucks. During this period the old bucks engage in fierce contests among themselves, which occasionally terminate fatally.

The young, generally one but occasionally two in number, are born in May or June, after a gestation of about twenty-eight weeks, and are clothed with a thick woolly coat of a reddish colour. When but a day old they are able to follow their dams almost anywhere; and in three months first show their horns. In three years they attain their full size; and it is stated that the span of life of a chamois will extend from twenty to twenty-five years, although this requires confirmation.

All who have seen chamois in their native haunts are agreed as to their extreme agility and wariness; and their sure-footedness has become proverbial. When alarmed, they utter a shrill whistling sound, which at once sets the whole flock in

rapid motion. A chamois is able to stand on the summit of a pinnacle of rock with all its four feet gathered into a space of the size of a crown piece ; and as its



THE LEAP OF THE CHAMOIS.

sense of sight, smell, and hearing, are of the acutest, its pursuit taxes the utmost powers of the hunter.

ELAND.

Genus *Orias.*

With the large and handsome African animals known as eland, or impofo, we come to the first representatives of the extensive group of antelopes, which includes the whole of the remaining members of the bovine family. Although the term antelope is one in common use, and most of the members of the group are easily recognised, yet, owing to the number of generic types and the diversity of their structure, it is exceedingly difficult to distinguish antelopes as a whole from the oxen on the one hand and from the goats on the other; the transition to the former group being effected by means of the anoa, and to the latter by the goat-like antelopes just described. Antelopes are, indeed, the most generalised members of the present family now existing, and since they are also its oldest known representatives, it is probable that from them have been derived the more specialised types already treated of, so that the above-mentioned transitions are precisely what we might naturally expect to occur.

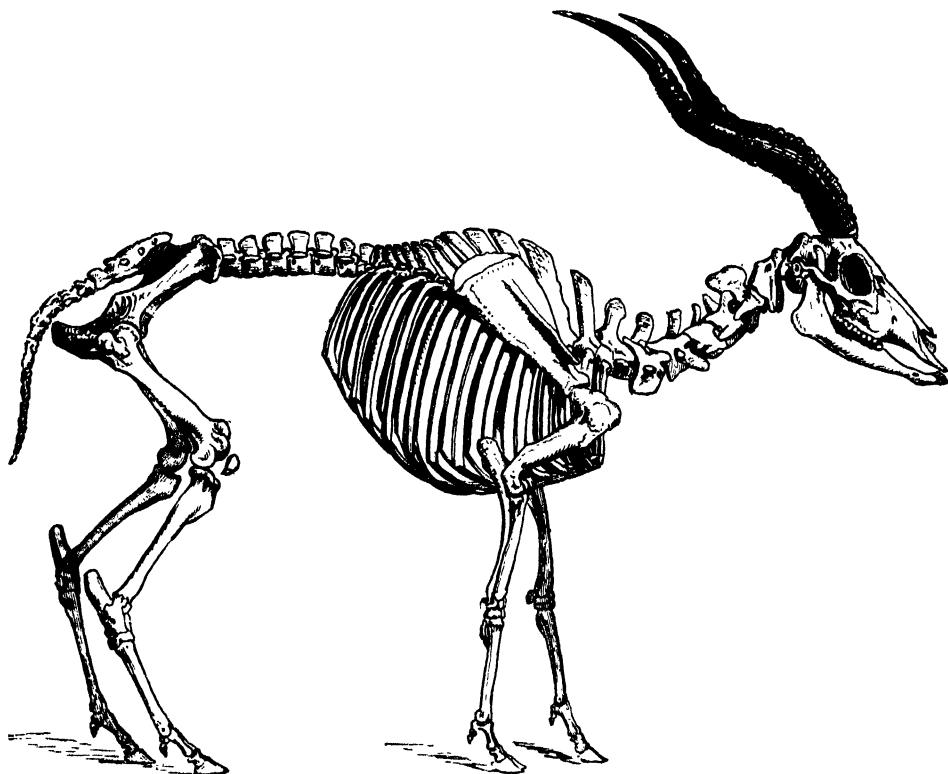
Characters of Antelopes. As a whole, antelopes are characterised by their graceful build, and by the head being carried considerably above the level of the back. The horns, which may or may not be present in the females, are generally long, more or less cylindrical, and often lyrate in shape; while they are frequently marked with prominent rings, and have an upright direction. Their bony internal cores, instead of being honeycombed, as in the oxen, sheep, and goats, are nearly solid throughout. These animals very generally have a gland beneath the eye, by which they are distinguished from the oxen and goats; but, as regards their teeth, some of them resemble the oxen, while others approximate to the sheep and goats.

Distribution. Antelopes (in the proper sense of the word) are strictly confined to the Old World; and by far the greater majority of them are now restricted to Africa, with the adjacent regions of Syria and Arabia. Indeed, if we except the widely-spread group of gazelles, the only antelopes found beyond those



HEAD OF BULL ELAND.—After Nicolls and Eglington.

regions are the black-buck, four-horned antelope, and nilgai of India, the saiga of Tartary, and the chiru of Tibet. It was not, however, always so, since in early times antelopes of African types were distributed over a large portion of India and Southern Europe; and it is still one of the problems of zoology to account satisfactorily for the disappearance of these animals from the latter regions. The introduction of antelopes into Africa appears to have been comparatively recent; but having once made good their footing on that continent they multiplied, both as regards individuals and species, in a manner quite unparalleled in any other region, the total number of African antelopes exceeding ninety. Unfortunately,



SKELETON OF THE ADDAX.

this profusion and exuberance of ruminant life, which, but a few decades back, characterised the dark continent, is rapidly disappearing before the advance of civilisation.

Eland. The eland belongs to a group of large and almost exclusively African antelopes, characterised by the general absence of horns in the females, and by those of the male being devoid of rings, angulated in front, and usually spirally twisted. There is a small gland below the eye, the muzzle is naked, the tail long, and the upper molar teeth generally have short crowns.

Eland are the largest of all antelopes, and differ from the other members of the group in having horns in both sexes; these being spirally twisted on their own axis and directed upwards and outwards. The horns have a sharp ridge both in

front and behind, and are directed upwards and outwards in the plane of the face. The naked muzzle is broad, the gland below the eye small, and the tufted tail reaches below the hocks. Both sexes have a large dewlap; and the crowns of the upper molar teeth are low and broad. The common eland (*Oryx canna*), which formerly ranged over the greater part of South, East, and Central Africa, is char-



THE ELAND ($\frac{1}{20}$ nat. size).

acterised by the horns of the cows being longer and thinner than those of the bulls. The bulls have a tuft of long dark brown hair covering the forehead; but the colour of the rest of the head and body varies from pale fawn to bluish grey; the blue tint being most marked in old individuals—more especially bulls, in which, owing to the scantiness of the hair, the colour of the skin shows through. In the southern part of its range the eland is uniformly coloured, but further north there occurs a variety in which the body is marked with vertical white stripes,

descending from a dark stripe on the back. The degree of distinctness of these stripes varies greatly in different individuals; and frequently in this variety there is a white stripe across the nose, while there is always a dark patch on the inner side of the knee. Mr. Crawshay states that in Nyasaland, among a single troop, individuals may be seen varying from a light tawny yellow to a slaty blue in very old age, while in some the stripes are clearly defined, in others faintly, and in others again they are not distinguishable at all. An average-sized bull eland shot by Mr. Selous stood 5 feet 9 inches at the withers, but some specimens are doubtless taller. Mr. Drummond states that the average weight varies from 800 to 1100 lbs., but that in old bulls it may reach 1400 or even 1500 lbs. The average length of the horns may be set down at 25 inches for bulls and 26 inches for cows; but Mr. Selous has recorded a length of 30 inches in the former and 34 inches in the latter. In old bulls the horns may be worn down to less than a foot in length.

Distribution. The eland was formerly distributed over all Southern and Eastern Africa, but has now disappeared from the Cape Colony, Natal, the Orange Free State, Griqualand West, and the Transvaal. A few years ago these antelopes were, however, abundant in the districts between the Chobi and Zambesi Rivers, as well as in the country to the north of the latter; while they are still plentiful in parts of Nyasaland, and are not uncommon in the Kilima-Njaro district. Their complete extirpation is, however, probably merely a matter of time; the animal being slaughtered on account of its hide.

Habits. Eland are found both in the desert-country, and in wooded districts, both hilly and flat. In Nyasaland Mr. Crawshay says that their favourite haunts are undulating, well-timbered country, where the grass is not too long, and where there are intervening open plains; as a rule, they visit the plains at night or in the early mornings to drink, and then wander back long distances to the forest, where they spend the hot hours of the day. In the great Kalahari Desert, where they are still common, Mr. Selous states, however, that eland go a long period without drinking any water, except that which they may obtain by eating water-melons and other plants. Eland are generally found in large herds, numbering from fifty to upwards of a hundred head, but solitary bulls or small parties of bulls are not unfrequently observed.

Elands are generally accompanied by "rhinoceros birds," which, in addition to their natural timidity, make them difficult to approach on foot. Consequently they are generally hunted on horseback. The bulls, when fat, can be easily ridden down by a good horse; but the cows have greater speed and staying power. When pursued, eland frequently leap high in the air. The calves are born in July and August; and it appears that the females do not breed oftener than once in every two years, so that the rate of increase is slow. When they have their calves with them, the cows will attack and impale dogs on their horns; but at other seasons both sexes are quite harmless. Mr. Selous states that the flesh of the eland has been very generally over-estimated; and during the dry season, when these animals often subsist entirely upon leaves, it is quite uneatable. In captivity the eland breeds freely; and it was at one time considered that it might be profitably acclimatised in England.



MALE AND FEMALE KUDU.

Abnormal Horns. Occasionally, cow eland are found with one or both horns abnormally formed; such abnormal horns being long and nearly straight, with a triangular cross-section. Such a pair, measuring 30 inches in a straight line, were described a few years ago under the name of *Antilope triangularis*, and were supposed to indicate an extinct species of antelope, which was subsequently referred to a new genus.

Derbian Eland. The magnificent animal known as the Derbian eland (*O. derbianus*), replaces the common species on the West Coast in the districts of Angola and Senegambia. It is considerably larger than the southern and eastern form; and the bulls have a large dark brown mane and much finer horns. The horns of the cows are, however, relatively small. Male horns have been measured of $34\frac{1}{2}$ inches in length.

KUDU.

Genus *Strepsiceros*.

The graceful and beautifully marked antelopes known as kudu, of which there are likewise two species, are distinguished from eland by the absence of horns in the female, and by the cork-screw-like spiral formed by those of the male, as well as by the much shorter tail, which does not reach the hocks. The horns are characterised by the great development of the front ridge, and rise from the skull at an obtuse angle to the plane of the face. The neck is maned, and the throat may be furnished with a fringe of long hair. The body is marked with narrow vertical white stripes descending from a white line on the back; and there is also a white chevron on the face, together with white spots on the cheek, and splashes of the same colour on the throat and limbs. The hoofs are short.

Common Kudu. The common kudu (*Strepsiceros kudu*), which is the species represented in our illustration, is distinguished by its large size, the



HEAD OF KUDU.—After Nicolls and Eglington.

open spiral formed by the enormous horns of the male, and the presence of a thick fringe of hair on the throat. The ground-colour of females and young males is reddish or greyish brown, marked with eight or nine white stripes; but in old males it becomes bluish grey, apparently owing to the skin showing through the scanty hair. The kudu is only inferior in size to the eland; a full-grown bull standing about 4 feet 4 inches at the shoulder. The horns may attain a length of 3 feet 5 or 6 inches in a straight line, while one instance is recorded where the one horn measured 3 feet 9 inches, and the other 3 feet 9½ inches. In a pair measuring 3 feet 5 inches in a straight line, the length along the curve was 5 feet 4 inches.

Distribution. The geographical range of the kudu extends from the Cape to the Abyssinian highlands, embracing all Eastern Africa and extending westwards to Angola. Some years ago Mr. Selous stated that a few kudu still lingered in the Cape Colony, while in Griqualand West they were not uncommon. From the Limpopo to the Zambesi they were at that time abundant; and Mr. Crawshay records them as distributed all over Nyasaland. In the Kilima-Njaro district they appear to be rare. Mr. Selous states that the kudu is usually partial to hilly country covered with dense thickets; but hills are by no means necessary to its existence, as it is common in the thick bush along both banks of the river Chobi, where there are no hills whatever, and it is also plentiful in the wait-a-bit thorn-jungles on the Lower Molapo, just on the edge of the flat and sandy Kalahari Desert. In Nyasaland they are never found far away from the hills. Mr. Crawshay states that kudu are fond of browsing on the young and tender shoots of trees and shrubs, especially in the dry season, when the grass has been burnt off, and has not had time to grow. When alarmed, kudu sometimes give vent to a low bark, but this is only audible at close quarters.

Habits. Kudu are generally found in pairs or in small parties. Their speed is not great; but owing to the circumstance that when disturbed they invariably make for the roughest ground, while the districts they haunt are frequently infested with the tsetse fly, it is but seldom that they can be hunted on horseback. With dogs, however, they afford excellent sport; and Mr. Drummond gives the following graphic account of two bull kudu brought to bay by a pack of Kaffir dogs. "My eyes," writes Mr. Drummond, "were fixed upon the river, for there, on a small sandbank, stood the two noble kudu bulls at bay. Two or three dogs had also gained a footing, and made the air ring with their sharp barking, re-echoed back again and again by the precipice on which I stood; while several more swam about trying to stem the current and regain the ground which they had lost. One of the antelopes stood with lowered head, and his long circling horns pointed towards the dogs, and in his side I now saw that a spear was half buried; the other, evidently unwounded but unwilling to leave its companion, remained motionless, his nostrils thrown forward, as if to catch the first taint of the human pursuers sure to follow in their dogs' wake, and his equally magnificent horns resting almost on his haunches."

Lesser Kudu. The lesser kudu (*S. imberbis*) is a much smaller animal, apparently restricted to Somaliland and the Kilima-Njaro district. In addition to its inferior dimensions, this species is distinguished by the absence of a fringe of long hair down the throat, and by the more compressed spiral of its horns.

Measured in a straight line, the horns vary from about 17 to 25 inches in length. The lesser kudu, although very common about Kilima-Njaro, is but seldom seen, as it rarely leaves the bush. In Somaliland Captain Swayne states that while the large kudu frequents the mountain ranges, the present species inhabits the thicket-clad slopes at their feet.

An imperfect skull appears to indicate the occurrence of a kudu in India during the Pliocene period.

THE HARNESSSED ANTELOPES.

Genus *Tragelaphus*.

The harnessed antelopes, or bush-bucks, of which five species are now recognised, come so close to the kudus that it may be a question whether they ought not to be included in the same genus. They are, perhaps, the handsomest of all the antelopes, being generally ornamented with vertical stripes like the kudus, while in some cases the ground-colour is of a most brilliant hue. The harnessed antelopes resemble kudus in the females being hornless; but they differ in that the horns, which are placed behind the eyes, have but one or two turns to the spiral, while the ridge on their front surface is less strongly marked. Moreover, the skull generally lacks the deep depression in the middle of the forehead characteristic of the kudus, and the vacuity below the eye is of smaller size. The throat may be either fringed or smooth; and in some species the hoofs are extraordinarily elongated. The coloration of the two sexes is usually very different. The group is confined to Africa; and whereas four of the species are of large size, the fifth does not exceed the dimensions of an ordinary goat.

Bongo. The largest of all is the West African bongo (*Tragelaphus eurycercos*), from Liberia, Fanti, the Ashkankolu mountains, and the Gabun. It has short hoofs, and is distinguished by its short hair, the deep chestnut colour of the males, the numerous and distinct narrow white stripes, the want of a fringe on the throat, and the smooth and massive horns, forming rather more than a single turn, and wearing yellow at their tips. The chest is marked by a white crescent, and there are two white spots on the face below the eye. The males attain a height of 3 feet 7 inches at the shoulder; and the horns may reach a length of 30 or 31½ inches in a straight line. We have practically no knowledge of the habits of this species, except that, like the rest, it is a forest-dwelling one.

Nyala. In East Africa, in Zululand, and St. Lucia Bay, the bongo is replaced by the nyala (*T. angasi*). The males stand about 3 feet 4 inches at the withers, and have horns varying from 22 to 28 inches in length. The hair is long, and the general colour of the males dark bluish grey, with the white stripes faintly marked and few in number, and a fringe of long hair on the neck and under-parts of the body. The horns are characterised by their rough surface. Mr. Drummond states that these antelopes are only to be found in low-lying, fever-stricken swamps, where they frequent the densest jungle they can find. They are shy and difficult to stalk; and from this circumstance, coupled with the

feverish nature of their haunts, comparatively few are killed by Europeans. The ground-colour of the female's fur is reddish.

**West African
Harnesssed
Antelope.** The third species is the West African harnessed antelope (*T. gratus*), from the Camerun mountains and the Gabun district, of which the head is figured in the accompanying woodcut. This

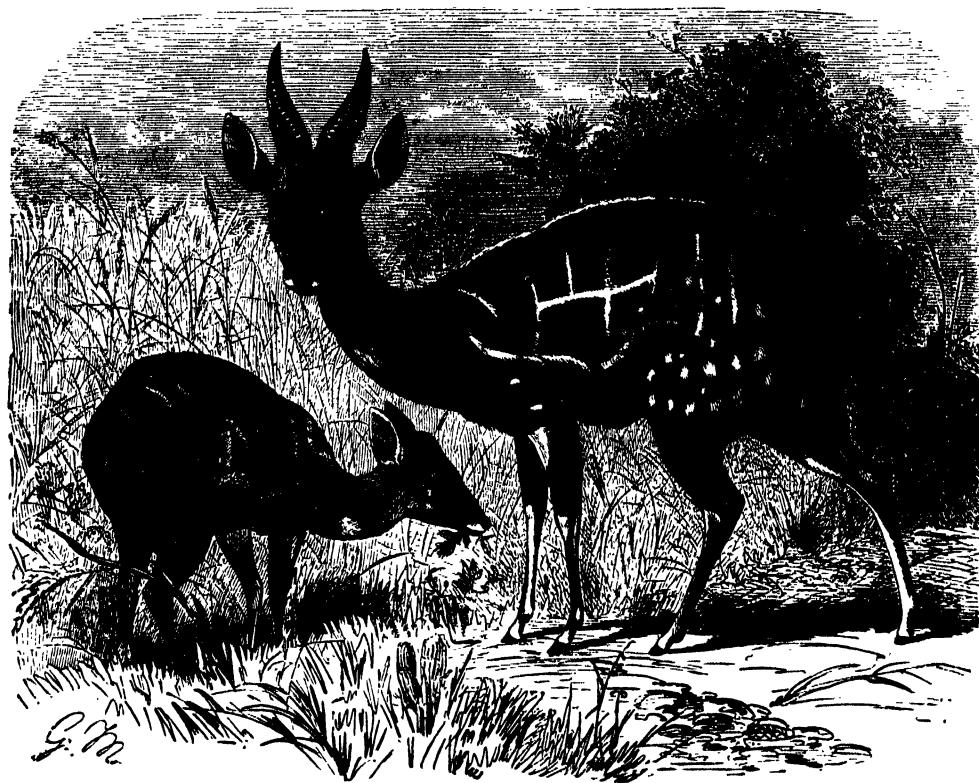


HEAD OF WEST AFRICAN HARNESSSED ANTELOPE.
(From Sclater, *Proc. Zool. Soc.*, 1883.)

antelope agrees with the last in having white spots on the head and stripes on the body, but differs from all those yet noticed in the extreme elongation of the main hoofs, which are evidently specially adapted for walking on swampy ground. The lateral hoofs, moreover, which in most of the foregoing species are extremely small, are in this antelope large and elongated. The male stands about $3\frac{1}{2}$ feet at the shoulder; and is characterised by the absence of a fringe of long hair on the throat, and the dark olive tint of the coat. In the female the ground-colour of the fur is bright rufous, ornamented, as in the male, with white spots on the face and stripes on the body. The horns of the male are generally about 18 or 19 inches in length, measured in a straight line. Little or nothing appears to be known as to the habits of this species in its wild state, but several examples have been exhibited in the Zoological Gardens at Amsterdam, where they have bred.

Nakong. The last of the four large species of harnessed antelopes is the nakong or sititunga (*T. spekei*), of the swamps of Central and South-Central, and East Africa. This species, while agreeing with the last in its elongated hoofs, differs from all those yet noticed in its perfectly uniform greyish brown colour. The young are, however, faintly striped and spotted. The hair is longer and more silky than that of the others; and the smooth, slender, and strongly-ridged horns form nearly two complete turns, and thus approximate to those of the kudu. The height of the male is 3 feet 7 inches. Mr. Selous states that the longest horns he met with measured 25 inches in a straight line, but a pair of 27 inches has been subsequently recorded. Like the other members of the genus, the nakong goes in pairs, and is never found in herds. Mr. Selous observes that he once saw a female nakong "standing breast-deep in the water, in the midst of a

bed of reeds, feeding on the young shoots that just appeared above the water. When she saw us, she at once made off, making a tremendous splashing as she plunged through the water. The natives told me that very often when these antelopes are met with under similar circumstances they do not attempt to run, but, sinking down in the water, submerge their whole bodies, leaving only their nostrils above the surface, and trusting that their enemies will pass them unobserved. They (the Kaffirs) then paddle alongside, and assegai them from the canoe. Another way the natives have of killing them is by setting fire to the reeds when they become quite dry, and then waiting for the sititunga in their canoes in one of the channels of open water by which the marsh is intersected." Further up the Chobi River it is stated that these antelopes are in the habit of diving, and even sleeping beneath the water with only their nostrils exposed.



MALE AND FEMALE GUIB ($\frac{1}{4}$ nat. size).

Guib. The guib (*T. scriptus*) is the last representative of the harnessed antelopes, and differs from all the others by its inferior size, being about equal in dimensions to an ordinary goat. The average length of the horns is about 12 inches, but specimens of 14 inches and one of 16 $\frac{1}{4}$ inches have been recorded. This species has a wide distribution, ranging from Abyssinia to the Cape; and it exhibits such variations in colour that it was originally split up into four distinct species, now regarded as varieties. In the Abyssinian variety, which is shorter and stouter than the others, the general colour is yellowish, and the

stripes are nearly obsolete ; but there is one distinct longitudinal band, sometimes broken into spots, and the haunches are spotted, while the back has a dark line. In the typical variety, from West, Central, and South-Central Africa (which is the one represented in the illustration on p. 277), the colour is bright rufous, brilliantly marked all over the body with white spots and longitudinal and vertical stripes. In the males the line down the middle of the back is white ; and the chest has a fringe of blackish hair. In East Africa we come across a third variety in which the general colour of the bucks is dark brown, with two or three obscure vertical stripes on the hind-quarters, and even these occasionally absent. The spots are variable, although less numerous than in the preceding variety. Lastly, we have the true bush-buck of the Cape, in which the coloration is of a uniform dark brown at all ages, with no trace of stripes, and the spots reduced to a few indistinct ones on the haunches.

Guib, or bush-buck, are very common in most parts of Africa. Writing of this species, Mr. Selous says that it is "never met with except in places where dense bush comes right down to the water's edge ; and on the Chobi, where I have seen most of these antelopes, I have never found one at a distance of more than a hundred yards from the river."

Extinct Species. Remains of antelopes more or less nearly allied to *Tragelaphus* are common in the Tertiaries of Europe, as far down as the Middle Miocene, so that the group is evidently a very old one.

THE NILGAI.

Genus *Boselaphus*.

The nilgai (*Boselaphus tragocamelus*), which is the largest of the Indian antelopes, appears to be the oriental representative of the group of African species described above, although it differs from them in several important structural features. The males only are horned, and the horns themselves are short, smooth, nearly straight, and directed upwards and backwards, with a triangular section at the base, but becoming cylindrical at the tip. In front the horns have a distinct ridge, comparable to that found in those of the eland, and in very old individuals this ridge extends forwards and inwards, till the horns almost touch at their bases. The nilgai is peculiar in having the fore-limbs longer than the hinder, and the withers very high, in consequence of which its whole appearance is somewhat ungainly. The tail is tufted, and reaches the hocks ; and in both sexes the neck is maned, while the throat of the male has a small tuft of hair. The gland below the eye is very small and the muzzle naked. The upper molar teeth (one of which is figured on p. 155) differ from those of the foregoing species by their tall crowns, with a large additional column on the inner side. In general colour the adult bull nilgai is dark grey, with either a brownish or bluish tinge. The long hairs on the neck, throat, and tail, and some portions of the ear, are however black ; and there are white markings on the face, ears, and throat, while the under surface of the tail, the under-parts of the body, and a ring above and below each fetlock are likewise white. In young males and females the colour is brown. A bull nilgai

usually stands from 4 feet 4 inches to 4 feet 8 inches at the withers, but it is stated that 4 feet 10 inches has been measured. The cows are much smaller. The black horns average 8 or 9 inches in length, with a basal girth of 8 inches; but one pair has been recorded with a length of $11\frac{1}{2}$ and a girth of $9\frac{1}{2}$ inches.

Distribution. The nilgai is exclusively an Indian animal, being quite unknown in Ceylon. Even in India its distribution is restricted, as it does not occur in Eastern Bengal or Assam nor, apparently, near the Malabar coast. Fossil



THE NILGAI ($\frac{1}{4}$ nat. size).

species occur in the river-gravels of Central India, and also in the Pliocene sandstones of the Siwalik Hills at the foot of the Himalaya.

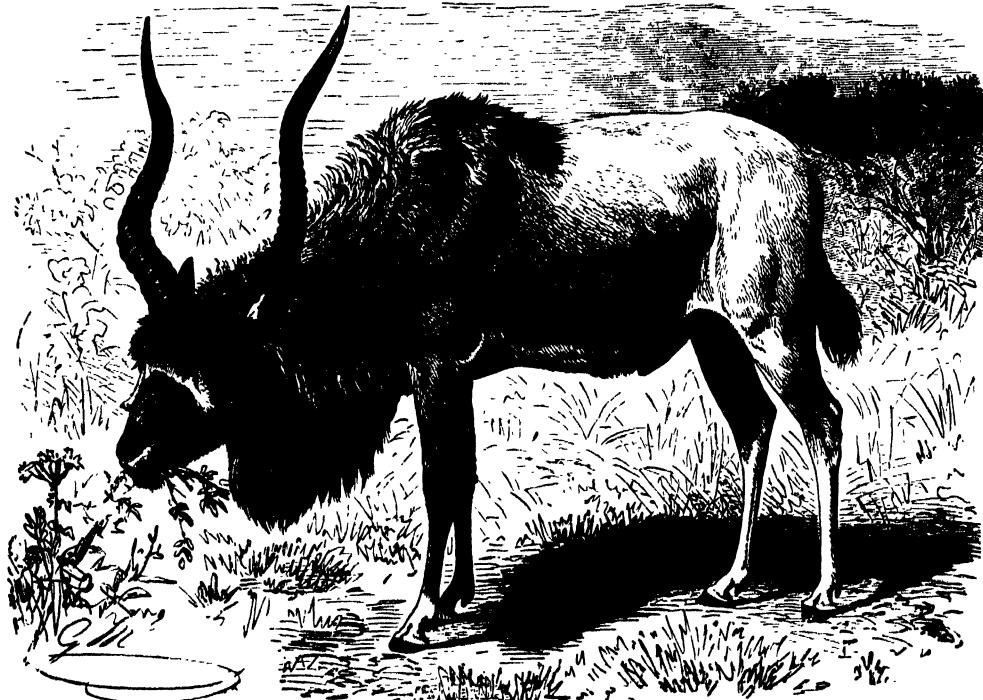
Habits. Nilgai may be found either on the plains or in low hills, generally preferring ground covered with thin bush, among which are scattered low trees, or alternations of scrub-jungle with open grassy plains. They are but seldom met with in thick forest, although far from unfrequent on cultivated grounds. The bulls are generally solitary, but occasionally assemble in small parties, which, according to Mr. Blanford, may include as many as a dozen head. The females and calves are generally found in parties of from four to ten, but sometimes in herds of from fifteen to twenty or more, and they are on some

occasions accompanied by one or more full-grown bulls. Nilgai both graze and browse, and will feed at any time of the day, although they resort sometimes to the shade for repose. Mr. Blanford believes that, in the cold season, at least, they drink but once in two or three days. General Kinloch writes that "in places where they are not disturbed, especially in some of the native states, nilgai are absurdly tame, but in districts where they are much molested they become extremely shy and wary. It must not, therefore, be supposed that they can always be easily shot, but they afford such a poor trophy that they are not much sought after. When they can be found sufficiently far from thick cover they may be speared, and they then show capital sport, as they will probably lead a well-mounted horseman a chase of several miles. On hard ground I doubt if a cow nilgai could be speared by a solitary hunter; the bull, being much heavier, is more easily ridden down." They can be readily tamed, but the bulls are apt to be savage. Either one or two young are produced at a birth.

THE ADDAX.

Genus *Addax*.

With the addax (*Addax nasomaculatus*) we come to a group of African and Arabian antelopes of large size, including the genera *Addax*, *Oryx*, and *Hippotragus*,



THE ADDAX (♀ nat. size).

which present the following distinctive characteristics. They have long cylindrical horns in both sexes, which are placed over or above the eyes, and are either sub-

spiral, straight, or recurved. The muzzle is covered with hair, and there is no gland below the eye; while the skull has no depression below the socket of the eye, and but a very narrow unossified space in the same region. The tail is long and tufted, and the upper molar teeth resemble those of the oxen, having very tall and broad crowns, with a large additional column on the inner side. It is probable that this group is very closely related to the oxen; and all the members are desert-haunting animals.

The addax, which is an inhabitant of North Africa and Arabia, has the horns ringed for the greater part of their length, and ascending in an open spiral nearly in the plane of the face. In height this antelope stands a little over 3 feet, and the greater part of the body is covered with short and thick hair. There is, however, a tuft of long hair on the forehead and a mane extending down the neck to the shoulders, and also a fringe of long hair on the throat. The general colour is yellowish white, in marked contrast to which is the brown of the head, neck, and mane. There is a transverse white band below the eyes, while the lips and a spot on the outer surface of the ears are also white. In the males the long hair is more abundant and darker in colour than in the other sex, and during the winter the yellowish white of the body tends to grey. The horns attain a length of from 20 to 28 inches in a straight line, and from 26 to 35 $\frac{1}{2}$ along the spiral.

Distribution and Habits. The range of the addax in Africa lies to the northward of the

18th parallel of north latitude, and, like the gemsbok, the animal inhabits barren, sandy deserts, where water is scarce. It is a shy and wary creature, and is doubtless able to go for long periods without slaking its thirst. Our accounts of its habits are far from full, but its general mode of life is probably very similar to that of the gemsbok. The addax is hunted by the Bedouins, partly for the sake of its flesh, partly in order to capture the young, and also to test the speed of their horses and greyhounds. Large hunting-parties are assembled for this purpose, and the expeditions may last for several weeks. The skeleton of the addax is figured on p. 268.

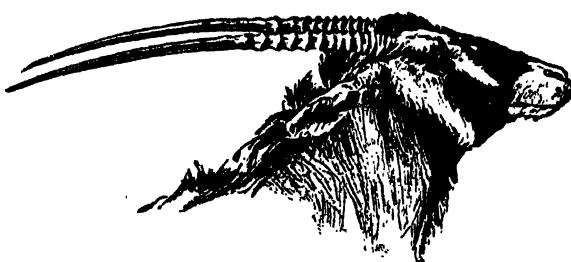
ORYX.

Genus *Oryx*.

Under the title of oryx may be included five species of antelope, distinguished from the addax by their straight or recurved horns, their longer and more bushy tails, the small size of the mane on the neck, and by the throat being either short-haired or furnished with a single tuft of long hair. The horns, which are of great length, slope backwards more or less nearly in the plane of the face. Oryx are found throughout the desert regions of Africa, and also range into Arabia and Syria.

Gemsbok. Commencing with South Africa, we find the group represented by the gemsbok (*Oryx gazella*), characterised by its long straight horns, ringed for about half their length, the tuft of hair on the throat, and the black markings on the head, body, and limbs. The gemsbok stands about 4 feet in height, and its general colour is greyish, becoming white beneath. A black stripe on the flanks divides the grey of the sides from the white below, and there is also a

black area on the haunches extending as a line on the back, and continued over the whole of the tail. In addition to this, there is also black on the upper-parts of the limbs, on the front of the legs above the fetlocks, and along the throat; the



HEAD OF GEMSBOK.—After Nicolls and Eglington.

throat-stripe dividing and running up the sides of the head nearly to the ears. On the face a black stripe runs from each horn through the eye nearly to the muzzle, which is connected by a narrow stripe with a broad black patch on the centre of the forehead, thus completely isolating the white of the muzzle from that of the upper part of

the face. Mr. Selous states that the longest male horns of this species which he saw measured 42 inches in length, while those of the female may reach $46\frac{1}{2}$ inches. Horns have, however, been recorded measuring $47\frac{1}{2}$ inches.

Distribution and Habits. Gemsbok inhabit the desert regions of South-Western Africa,

and are still fairly common in the Kalahari Desert, while in Damaraland they are reported to occur in large herds; north of the Chobi River they appear to be unknown. On the west coast they occur in Senegambia, Timbuctu, and the Niger district. Mr. Selous says that they are generally met with where the country is either completely open or covered with stunted scrub. Gordon Cumming writes that the gemsbok "thrives and attains high condition in barren regions where it might be imagined that a locust would not find subsistence; and, burning as is the climate, it is perfectly independent of water, which, from my own observation and the repeated reports both of the Boers and aborigines, I am convinced it never by any chance tastes. Its flesh is deservedly esteemed, and ranks next to the eland." Mr. Selous states that the gemsbok is by no means fleet, and that it can be run to a standstill by a hunter on foot. According to Boer reports, the gemsbok is enabled to beat off the lion with its spear-like horns; and several instances are recorded where the skeletons of the two animals have been found together, the body of the lion having been transfixed by the horns of the antelope, which remained too firmly fixed in the flesh to admit of their withdrawal during life.

Beisa. In Abyssinia and Somaliland as well as on the Red Sea littoral

near Suakin, the gemsbok is replaced by the beisa (*O. beisa*), readily distinguished by the absence of the tuft of hair on the throat, and by the black patch on the front of the face being completely separated from the stripe running through the eye. There is no black on the haunches and thighs, and the horns also are shorter and less divergent, their maximum recorded length being 36 inches in the male and 37 inches in the female. The beisa is probably the true oryx of the ancients, and may be the animal which gave rise to the legend of the unicorn. Mr. Blanford says that in Abyssinia these animals are found in herds of considerable size, when they present an imposing appearance. Their favourite pace is a quick walk or trot, and they only break

into a gallop when frightened. At such times they dash off with lowered heads and upraised tails, at the same time puffing and snorting. In Somaliland the beisa, according to Captain Swayne, chiefly frequents open stony grounds or grassy plains, but it may be found in any kind of country except thick jungle or the cedar forests. The herds are chiefly composed of cows, the bulls wandering about by themselves.



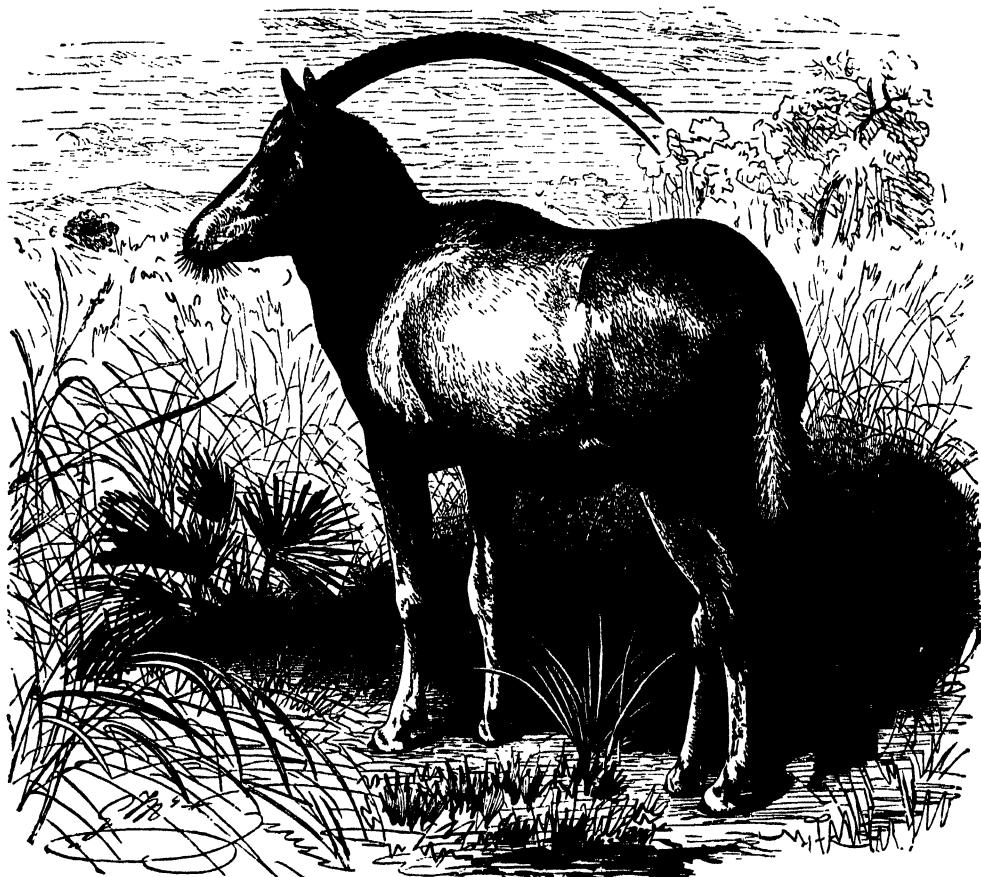
THE BEISA ($\frac{1}{2}$ nat. size).

The Midgans of Somaliland hunt the beisa with packs of yellow pariah dogs. One of the largest pair of horns measured $34\frac{1}{2}$ inches in length.

Fringe-Eared Oryx. In the Kilima-Njaro district the genus is represented by the fringe-eared oryx (*O. callotis*), distinguished from the beisa by the ground-colour of the upper part of the face being of a rich fawn, and by the sharply-pointed ears terminating in a tuft of long black hair, as shown in the illustration on p. 287. This species is common in the plains and the tracts of thin thorny bush. In examples killed by Sir J. Willoughby the horns in the females measured from 30 to 32 inches in length, while those of the males were shorter, but thicker.

Beatrix Antelope. --- The beatrix antelope (*O. beatrix*) of Western Arabia, and, it is said, of the Bushire district, is a much smaller animal than either of the above, standing about 2 feet 8 inches in height, and is of a whitish colour, with a dark spot on the face, and a large dark patch on each cheek meeting beneath the throat; the knees and the front of the lower part of both legs are also blackish brown, and the end of the tail is black. The horns are only about 15 inches in length.

Sabre-Horned Antelope. --- The last representative of the genus is the sabre-horned antelope, or leucoryx (*O. leucoryx*), which, while agreeing nearly in size with the beisa, differs from the other four species in its recurved scimitar-like horns,



THE SABRE-HORNED ANTELOPE ($\frac{1}{2}$ nat. size).

and uniform whitish coloration, which frequently shows a reddish tinge. The reddish tinge is more marked in the under-parts and the inner surfaces of the limbs than elsewhere; and the neck is darker than the body. The head is marked by six brown patches, of which there are one between the horns, two between the ears, and two between the horns and eyes, while the sixth forms a streak on the nose. The horns vary from 34 to $39\frac{1}{2}$ inches in length. The leucoryx is confined to the north-eastern portion of Central Africa, being abundant in Senaar and

Kordofan, less common in the Central-Western Sudan, and also occurring in parts of Nubia.

Extinct Forms. In the Pliocene deposits of various parts of Europe, there occur remains of antelopes closely allied to the oryx, some of which have been generically separated under the name of *Palaoreas*, and are said to show signs of affinity with the sable antelope and its kindred.

THE SABLE ANTELOPE AND ROAN ANTELOPE.

Genus *Hippotragus*.

The sable and roan antelopes, together with some allied species, constitute an exclusively African genus nearly allied to the oryx. They are distinguished by the stout horns, which are ringed nearly to their tips, rising vertically from a ridge on the skull immediately over the eyes at an obtuse angle to the plane of the lower part of the face, and then curving in a bold sweep backwards. The neck is clothed with a distinct, erect, and often-recurving mane; the tail is rather short and distinctly tufted; and the ears are enormous. The horns of the females are shorter than those of the males.

Roan Antelope. The roan or equine antelope (*Hippotragus equinus*)—the bastard gemsbok of the Boers—is represented in the right-hand figure of our illustration on next page, and is the largest and one of the best-known representatives of the genus, standing rather over $4\frac{1}{2}$ feet at the withers. There is considerable individual variation in colour, some specimens, according to Mr. Selous, being of a strawberry roan, others of a deep dark grey or brown, and others again so light in colour as to appear almost white at a distance. The under-parts are but little lighter than the body, while the head and jaw have dark brown markings. The latter markings are characterised by the white streak in front of the eye being separated by a dark band from the white of the muzzle. The ears are very large, and the mane small and erect. The horns of the bull seldom exceed 36 inches in length, measured along the curve, but specimens measuring 33 and 42 inches have been recorded. This species has a large range in central South Africa, and has also been recorded from Senegal. Mr. Selous states that it is nowhere numerous, and it is seldom that as many as twenty are seen together.

Blaubok. The blaubok (*H. leucophaeus*) was a smaller but nearly-allied species from the Cape, which now appears to be extinct. It derived its Dutch name from the bluish hue of the hairs, and its head was uniformly coloured.

Sable Antelope. Perhaps the handsomest member of the genus is the sable antelope (*H. niger*), represented in the left-hand figure of our illustration. This species is rather smaller than the roan antelope, but has much longer horns, smaller ears, and a longer and more abundant mane, which is partly pendent. With the exception of portions of the face, buttocks, and the under-parts, the fur is entirely of a deep glossy black; the contrast formed by the white of the under-parts being very striking; the markings on the face differ from those of the roan antelope in that the white streak in front of the eyes is continued to join the white of the muzzle, and is separated by a dark streak from that of

the throat. The horns of the males not unfrequently attain a length of 42 or 43 inches, but they may reach as much as 44½ or even 46 inches along the curve. In the females 36 inches seems to be the maximum.

Distribution and Habits. The sable antelope is a southern species, ranging some distance

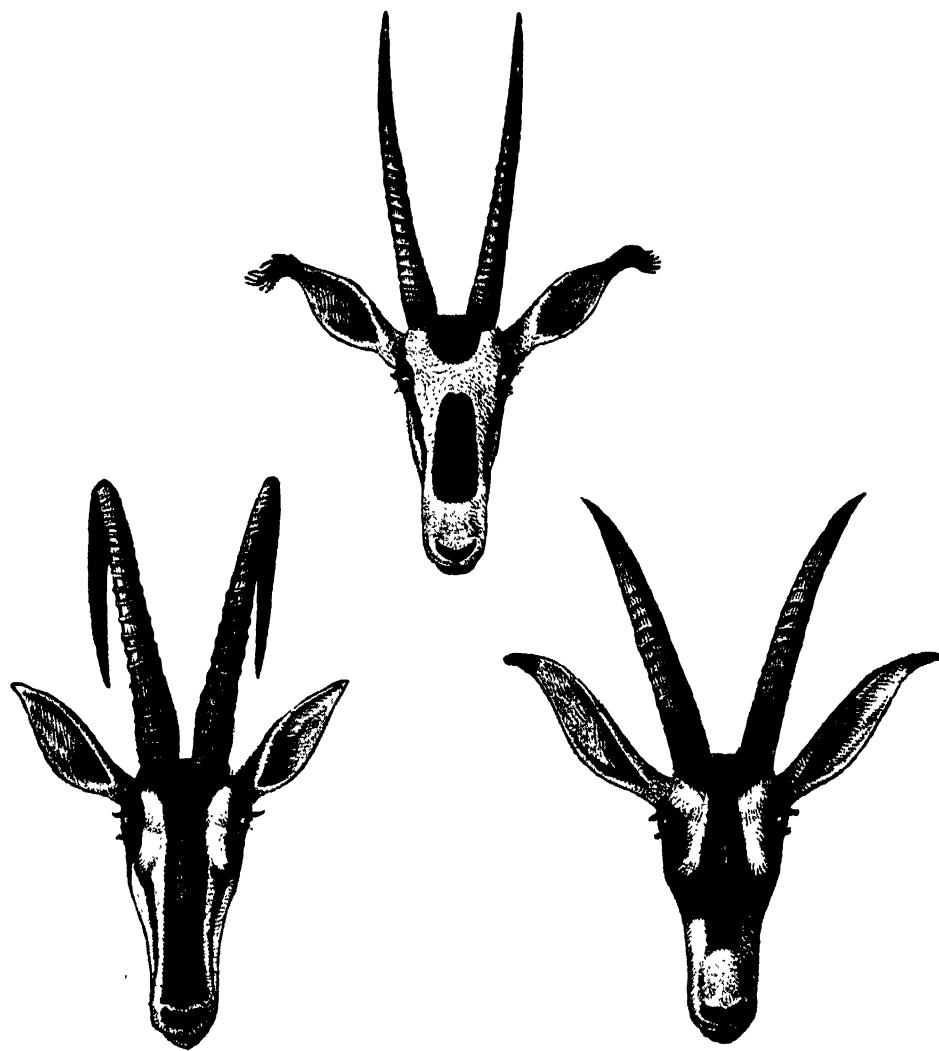
to the north of the Zambesi, and being now most abundant in Mashonaland. This antelope, unlike the various species of oryx, generally



THE SABLE ANTELOPE AND THE ROAN ANTELOPE ($\frac{1}{2}$ nat. size).

frequents forest-clad highlands. In Mashonaland, according to Mr. Selous, it is commonly met with in herds of from ten to twenty individuals, although occasionally as many as fifty may be seen together. The same writer observes that, "as a rule, the sable antelope runs very swiftly and has good bottom; but in this respect different individuals differ considerably, as is the case with all animals, and I have run down without much difficulty individual sable antelopes

and roan antelopes, and one gemsbok, whilst others have gone clean away from me. The sable antelope is often very savage when wounded, and, like the roan antelope and gemsbok, will commit terrible havoc amongst a pack of dogs. Indeed, I have known one to kill three dogs with three consecutive sweeps



FRINGE-EARED ORYX.

SABLE ANTELOPE.

ROAN ANTELOPE.

of its long scimitar-shaped horns." As mentioned on p. 573 of the first volume, the sable antelope is sometimes successfully chased by the Cape hunting-dog. From having been discovered by Sir C. Harris, it is frequently termed the Harris-buck by the inhabitants of the Cape.

All who have seen this antelope in its native wilds seem to be impressed with its beauty and majestic appearance. Gordon Cumming, writing of his first sight of the sable antelope, says that "I shall never forget the sensation I experienced on

beholding a sight so thrilling to the sportsman's eye ; he stood with a small troop of palas right in our path, and had, unfortunately, detected us before we saw him. Shouting to my pack, I galloped after him ; but the day was close and warm, and the dogs had lost their spirit. My horse being an indifferent one soon lost ground, and the beautiful creature, gaining a rocky ridge, was quickly beyond my reach, and vanished for ever from my view. I sought in vain to close my eyelids that night, for the image of the sable antelope was still before me."

In the Sudan the genus is represented by Baker's antelope **Baker's Antelope.** (*H. bakeri*), standing upwards of 4 feet 8 inches at the withers, and distinguished by its pale liver-colour, pencilled ears, and some black stripes across the shoulders. Its horns are of a massive type.

Fossil antelopes from the Pliocene deposits at the foot of the **Extinct Species.** Himalaya indicate the existence of the genus *Hippotragus* at a former period of the earth's history in India, and it is not improbable that it was also represented in Europe during the same epoch.



HEAD OF SABLE ANTELOPE.—After Nicolls and Eglington.

